Forestry

VETERINARY MEDICINE

JAN 19 1931

February, 1931

Contents

Fowl Typhoid and Pullorum Disease Identical 44
"Alkali Poisoning" an Infection 45
Vaccination Against Rabies 46
Roup and Avian Diphtheria Obsolete Terms 46
Mosquito Carriers of Fowl Pox 47
The Development of Spermatozoa 47
Collecting Overdue Shekels 48
Hemorrhagic Septicemia 50
Santonin a Specific for Ascarids 52
Milk and Health 53
Milk Inspection in a Small Town 54
The Nature of Milk Fever 58
Treatment for Laminitis 65
Infectious Abortion of Cattle, Swine and Sheep 66
Meat Inspection Covers Large Field 74
A Survey of Ictero-hematuria in Sheep in Colorado 75
Arthritis in a Cow 77
The Physiology of Egg Production 78
Chronic Septic Nephritis in a Cow 80
Thrombo-Embolic Colic 81
What's the Matter with Us 82
Neuritis in a Boston Terrier 84

No. 2
VOL. XXVI

75 E. Wacker Drive
Chicago, U. S. A.

THE SERUM SITUATION

A reprint of an editorial appearing in the January issue of the Fort Dodge Bio-Chemic Review.

Many veterinarians have recently expressed their disfavor and, in some cases, their open disgust over the chronic instability of prices on anti-hog cholera serum. Some of them are wondering—logically so—whether inconsistently low prices for this essential biologic may be reflected in the dependability of the product with resultant embarrassment to both themselves and their clients.

In the corn belt section of the country professional welfare and actual livelihood are directly related to the serum industry. Hence, if the serum industry is wrecked by unscrupulous price cutting and competitive evils, the profession and swine raisers will eventually be the real sufferers. If progress is to be made, essential research carried on, constructive advertising retained, then it is imperative that there be a fair profit on serum sales.

From the very beginning the Fort Dodge Serum Company has adhered strictly to one sound, basic principle of good business; namely, *never to sacrifice quality for the sake of price.* Regardless of any low market level on serum prices *we pledge absolute maintenance of this policy.* We have faith in the profession's appreciation of real quality and dependability.

FORT DODGE SERUM CO.

FORT DODGE, IOWA

U. S. Veterinary License 112

Veterinary Medicine

VOL. XXVI FEBRUARY, 1931 No. 2

Published Monthly by the Veterinary Magazine Corporation
75 East Wacker Drive, Chicago, Ill., U. S. A.
$4.00 a Year

Entered as second-class matter Nov. 8, 1920, at the post office at Chicago, Ill., under the Act of Mar. 3, 1879.
Entered as second-class matter under the title of American Journal of Veterinary Medicine, July 19, 1910. at Chicago, Illinois, under Act of March 3, 1879.

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D. M. Campbell, Editor A. T. Kinsley, Associate Editor

Research workers in the U. S. Public Health Service have demonstrated that Minot's liver extract, in the equivalent of 100 grams of fresh liver per day, will prevent the development of blacktongue in dogs when fed a diet devoid of the pellagra preventive vitamines.

Administered in large quantities, Minot's liver extract stopped the progress of blacktongue early in the attack.

The diagnosis of parasitism is an increasingly important problem because parasites are becoming more widespread and abundant. Clinical manifestations in a parasitized animal are of supplemental value only in the majority of cases of parasitism. Fecal examination gives positive evidence in some cases, and in others postmortem examination must be resorted to for a positive diagnosis. It is possible that in the future allergic reactions may be a means of identifying parasitisms.

It has been recognized for some years that soy beans are not a suitable food for fattening swine, resulting as it does in soft pork. However, experiments at the Illinois Station show that soy beans are a valuable addition to the ration of pregnant and suckling sows. Soy beans constitute a satisfactory source of protein for the development of the unborn litter and for stimulating a generous flow of milk to nourish the suckling pigs.

There are two ways of meeting present day conditions. One is to resist them; oppose them on every occasion; practice medicine as a curative function and take the chance of the medical profession becoming somewhat unsatisfactory before the public. The other is to take the present trend under our leadership and guidance and make it an asset both to the public and to the practice of medicine.—Wm. H. Ross, M. D.

In Maryland, it is found that nine out of every ten new outbreaks of hog cholera are caused by feeding hogs garbage, table scraps or kitchen swill that contain bones, rinds, or scraps of infected pork or the water in which such pork is washed or soaked. Just think of it. Hog cholera could be practically eliminated from Maryland by the observance of a little precaution in feeding the hogs. It is a form of farm relief that is in the hands of the farmers and no one else.—I. K. Atherton.

Br. abortus has apparently extended its activities, thus investigators have reported the finding of this organism in fistulous withers of the horse, a chicken disease, carpal hygromata in cows, necrosis of the vertebra in swine and undulant fever in man. From this it is apparent that *Br. abortus* is capable of adapting itself to different environments and thus it becomes an increasing menace to the health of animals and man.

Edwards and Hull in an experiment conducted at the Kentucky Experiment Station, found reaction to the agglutination test for pullorum disease quite consistent in 984 tests made on 88 hens, and the accuracy of the test was confirmed in 91% of the cases. This result is at marked variance with the result of similar experiments in Wisconsin and California, where agglutination tests in a flock of birds over a period of a year showed a high percentage of inconsistencies and a low percentage of agreement with autopsy findings.

FOWL TYPHOID AND PULLORUM DISEASE IDENTICAL

Both fowl typhoid and bacillary white diarrhea represent diseases which, through autochthonous not only in North America, but also in Europe, have but recently attained an eminent economical importance. Up to recent times it was generally accepted that fowl typhoid and bacillary white diarrhea are also from an etiological standpoint two distinct diseases, the first being caused by *Bacterium gallinarum,* Klein, the latter by *Bacterium pullorum,* Rettger. Bacteriological and serological investigations which at the same time, but independently from each other, have been carried out by the writer and by Klimmer and Haupt, led to the recognition of the fact that *Bact. pullorum,* while not representing a well defined, distinct species, may be regarded as but an inconstant variety of the *Bact. gallinarum* (Bacterium gallinarum var. pullorum). Fowl typhoid and bacillary white diarrhea are, therefore, two different manifestations of an etiologically uniform disease, the differences being due to variations in age of the animals involved. Epidemiological observations are not in contradiction with this bacteriological statement, for it may be assumed that losses among adult birds are, in the majority of cases, presumably due to pathological changes acquired during young age and originate probably, but in a minor part of the cases, from infections acquired during the adult stage.—Manninger, Budapest, at the Inter. Vet. Cong.

According to Goldberg and associates, lard and salt pork do not contain the essential ingredients to prevent black tongue in dogs, but canned haddock and dried green peas contain black tongue preventive factors, although there is a relatively small amount of such factors in the dried green peas.—*Public Health Service,* No. 1381.

Apart from the prevention of lamsiekte (phosphorus deficiency) the administration of bone meal was found by DuToit of the Union of South Africa to have a remarkably favorable effect upon the fertility of cows.

Calves born of dams that had received bone meal and which also were given bone meal attained sexual maturity at an earlier age than those not fed bone meal.

The administration of bone meal to cows doesn't seem to effect the weight of the calves at birth, but it certainly influences the rate of growth.

VISION OF PUBLIC HEALTH OFFICIALS

C. W. Stiles of the U. S. Public Health Service, who has had a vast experience in public health work, states:

"From the standpoint of administrative technique, the greatest function of the county health officer is to line up all his allies to play their roles to the limit. The difference between a percentage of roles these allies play and 100% of what they might play, represents the work the county health officer himself should perform in addition to his function of seeing that he does no work which he can induce his allies to do."

And, again: "His (the county health officer's) chief ally for treatment is the family physician, a greater ally than ever before and one whose field of treatment should be invaded as little as possible."

It is too bad that some of those engaged in live stock sanitary work have not the experience and the vision of officials in the Public Health Service.

St. Johnswort Hypericum perforatum has been incriminated as poisonous to live stock. The plant has been found to be toxic, by some cooperative feeding experiments. However, the poisonous effects are not pronounced and it is not likely to be a source of much trouble.—Tech. Bul. 202, U. S. Dept. of Agr.

In experimental investigational work on abortion disease at the Texas A. & M. College, it was found that of 48 cows in a herd receiving injections of live cultures of the Br. abortus, 32 required only one service for conception, 10 required two services, 2 required five services, one required six services, and one required seven services.

A rotary combine milker or "rotolactor" just put in commercial use for certified milk production at the Walker-Gorden Laboratories farm or "milk factory" near Plainsboro, New Jersey, milks 50 cows simultaneously with less cost, greater speed and less danger of contamination of milk than the old method of individual milking practiced for centuries. It requires 12½ minutes to wash and dry the udders and milk 50 cows. Operated continuously the rotolactor will milk 1,920 cows three times, or 2,880 cows twice daily. Two men are required to operate it.—*Science,* No. 1873.

Cryptorchidism has long been regarded as a heritable defect. At the Texas Station, some studies were made which showed that in goats, there is 5.4% of ridgling males produced where no ridgling sires are used, and nearly 50% by line breeding to cryptorchid males.

In these studies, it was shown that the right testicle was always the one retained. It was small in size and attached by membranes to the abdominal wall, or to various organs. Microscopic examination showed the presence of sperm in a few cases, but histological study of retained gonads showed complete degeneration of the germinal tissue.

The feeding of onions either cooked or raw in quantities of 15 grams or more daily per kilo of body weight produces a severe anemia in dogs.—Sebrell, *Pub. Health Rept.*

"ALKALI POISONING" AN INFECTION

In the last two decades, millions of wild ducks and other wild fowl have died in the Western states of a malady termed "alkali poisoning." The cause of the malady was not known, but it was deemed by many to be due to the alkaline properties of the water in certain marshes.

As a result of recent investigations of the Federal Biologic Survey, it is now believed that this malady of the wild fowl of the Western and North Western States is "limberneck"; that is to say, poisoning due to a poison elaborated by *Clostridium botulinum* type C, the common botulinus poisoning of domestic fowl.

Much still remains to be learned concerning the matter, but it is believed that the botulinus poisoning is elaborated in the rotting vegetable and animal matter in certain marshes and that the birds obtain it through eating decayed animal tissues or perhaps from eating larvae of the green fly, *Lucilia caesar,* since eating these larvae was shown about ten years ago, to be responsible for outbreaks of botulism in domestic fowl in various parts of the United States.

Ducks affected with this disease exhibit symptoms of marked weakness of the leg, wing, and neck muscles. In the early stages there is unsteadiness in walking, inability to fly, a tendency to move the head from side to side and backward, and failure of the nictitating membrane of the eye to function. Later the bird assumes a prone position and is unable to rise, the neck muscles gradually lose their power, and the head droops to the ground. The breathing is slow and often accomplished by opening the bill. Death may ensue in from a few hours to several days after the onset of the symptoms.

Preventive measures would appear to consist of the elimination of areas of mud flats by flooding or draining them, and the maintenance of deep fresh water.

Any protective rabies vaccination which is used after infection has occurred must be capable of establishing an immunity in a short time, with few injections at small cost, and it must be free from the danger of producing the disease itself. In the great majority of cases domesticated animals which have been bitten are protected by post-infection vaccination. This rabies vaccination can be used without injury on animals in advanced pregnancy, and on dairy cows because the vaccine when injected subcutaneously is not eliminated in the milk.—Aujeszky, Budapest, at the 11th International Veterinary Congress.

VACCINATION AGAINST RABIES

When one takes into consideration the fact that there is no need whatever to carry out the vaccination (against rabies) at a particular age (Hutyra), since it can be practiced upon dogs of any age, one realizes that the systematic vaccination of dogs is less complicated and easier of realization than one has been led to believe.

For reasons that will readily be understood, it has never been thought advisable to vaccinate cats against rabies.

The curative vaccination of the large herbivora (solipeds and ruminants) against rabies which has yielded such encouraging and certain results (Aujeszky), should be considered as an economic question, and not intimately connected with the special problem of rabies prevention.

Basing our opinion upon the results we have obtained and taking into consideration those obtained by other investigators, we conclude, with our eminent master, Valée, by stating that: "Vaccination by carbolized, etherized and formolized virus has furnished such proofs of its harmlessness, and also of its efficacy, that it would be advisable, if not to make it compulsory, at least to favor the widest possible application of it"; and by resolving that the sanitary authorities of the various countries should, in order that the campaign against rabies may be more effective, make anti-rabic vaccination compulsory as well as enforce sanitary police regulations. Finzi, Milan, at the Inter. Vet. Cong.

In the domesticated animals anthrax is most frequently of alimentary origin, while in the human subject the majority of cases are due to infection by way of the skin and of the respiratory tract. In animals a large dose of organisms is generally necessary to cause infection, while in man a small number of organisms is sufficient.

The statistics of anthrax infection in man, cattle, and pigs in Germany show a curve which is parallel with that of the importation of hides and foodstuffs. This connection between the occurrence of the disease and the importation of hides is particularly evident in the Province of Schleswig-Holstein, where the leather factories using large numbers of imported hides are situated. Mussemeier, Berlin, at the Inter. Vet. Cong.

ROUP AND AVIAN DIPHTHERIA OBSOLETE TERMS

Fowl pox is a contagious disease due to a filter-passing virus, characterized by eruptive lesions on the unfeathered parts of the head, by yellow cheesy membranes in the mouth, and by an oculo-nasal discharge. Any one or a combination of these lesions may be present.

It has been definitely proved that the epithelial growths on the comb and the yellow, cheesy membranes in the mouth are caused by the same filterable virus.

It is suggested, therefore, that in order to eliminate the existing confusion in the nomenclature of the disease, the use of the terms "roup" and "avian diphtheria" should be discontinued.

Every case of disease caused by fowl pox virus, irrespective of the symptoms manifested or the lesions induced, should be called fowl pox.

The disease is very contagious, the principal method of propagation being probably through wound infection. It is highly improbable that mosquitoes are an important factor in the dissemination of infection.

No evidence could be found of the existence of "carrier" fowls, and this is in agreement with the clinical history of outbreaks. —Doyle, Weybridge, at the Inter. Vet. Cong.

The medicinal and intoxicating properties of Cannabis indica were known among Oriental people at least as early as the fiftieth century, B.C., and the Greeks were familiar with it at least 2,000 years ago.

The significance of contagious abortion of animals, in its relationship to disease in man equals, if it does not exceed, bovine tuberculosis, and is in like manner primarily a problem of the veterinary medical profession. In the prevention of undulant fever, as in no other disease, members of the human and veterinary medical professions are called upon to unite forces in a common attack.—A. V. Hardy, in *Public Health Reports.*

MOSQUITO CARRIERS OF FOWL POX

It has been shown by Kligler, Muckenfuss, and Rivers that fowl-pox can be transmitted by mosquitoes. It is probable therefore that in some localities mosquitoes may be important agents in the transmission of the disease on farms and that other biting insects may be of importance in this regard.

Cutaneous vaccination with vaccine containing unattenuated virus has been found to be a satisfactory method for immunizing against fowl-pox by Johnson, Beach, Sawyer, Beaudette, and Stafseth and is now being extensively practiced on poultry farms.

Coryza has not been established as a specific infectious disease. Investigations by Pritchett, Beaudette, and Hughes have, however, shown that in many flocks the disease may be due to the localization in the nasal passages of infection with the fowl cholera organism. Stiles and Bunyea have reported favorable results in prevention and treatment of the disease from the use of a bacterin prepared from strains of Straphylococcus aureus of avian origin.

Vitamin A deficiency and infectious bronchitis of fowls are described as diseases involving the upper respiratory tract, which in some respects are similar to fowl-pox or coryza.—J. R. Beach, Calif., at the Inter. Vet. Cong.

An attempt is being made to produce a type of draft horse that will plough a 300 yard long furrow nine inches wide in the same length of time that is required by draft horses of the present time to plough a nine inch furrow 280 yards long. It is thought that this increase in rate of walking of the draft horse will mean the difference between profit and loss.

The cause of antirabic vaccine paralysis is unknown. Fortunately the percentage of this post vaccination malady is very low. According to information collected by the health committee of the League of Nations there was one case of paralysis in each 574 vaccinated in Italy, and one in each 5,514 vaccinated in Russia. The cause of such variations in the occurrence of this malady has not been determined, but is probably due to incomplete reporting of cases of paralysis.

THE DEVELOPMENT OF SPERMATOZOA

In Germany studies of the quantity and quality of spermatozoa produced by stallions with varying intervals between service, indicate that the rest period between services for normal spermatozoa production is 48 hours.

Daily mating caused an increase in the percentage of immature sperms. Matings after intervals of more than two days did not result in an increase in the number of viable sperms. Sexual stimulation did not appear to influence sperm production. Sperm production, however, was greatly influenced by the feed. A basal ration of 15 pounds of oats and 15 pounds of hay resulted in a sperm production of 2,885,701,420 per ejaculation. When the basal ration was supplemented with 10 hen eggs and 5 pounds of wheat bran daily, the sperm production was approximately three times as great. A supplement of dried peas and linseed cake increased the production over the basal ration only about 50%. Other proteins and lipoid supplements gave results varying between the oil cake and eggs.

Collecting Overdue Shekels

By FRED E. KUNKEL, Washington, D. C.

EVERY now and then the veterinarian encounters a Shylock who exacts his toll in the shape of an unpaid and very much overdue account, which, but for the pleading Portia of a corking collection system, might have lost the pound of flesh and so another bad account to be charged off to profit and loss.

Prompt collections depend upon, first, careful credit granting, and secondly, upon an efficient system for following up slow-pay accounts and thirdly, upon a rigid insistence upon "terms" being respected.

Many veterinarians let their accounts run too long and then suddenly wake up to the realization that their best collection efforts are completely baffled and results in the form of incoming checks barren and fruitless. But by prodding delinquent accounts by means of a persistent follow-up which never lets an account get cold on the books, the honest debtor can be warmed up to paying his account.

This system of continuous nagging in a friendly vein gets its psychological reaction in the form of payments in full or on account. And there is no use getting "hard-boiled" about it or in dipping your pen in vinegar when you pen that next collection letter, since such a method not only fails to bag the needed coin but it loses many an otherwise perfectly good account.

A regular series of result-tested letters and methods is also preferable to continuous searching and experimenting for an ideal collection letter. Such a series used by a veterinarian recently is here presented. It features the trip-hammer method of extracting checks, cash in hand, or definite promises to pay, by repeated mailings every ten days until the account is heard from, and so brings home the bacon without resorting to legal action or other unnecessary expense, or turning the account over to a collection agency.

These seven holy apostles preach an unmistakable sermon and the debtor is quick to sense their significance. Consequently, results begin to arrive anywhere along the line as the ten-day intervals elapse in quick succession, and when the last letter of this series is ready to go out the rank of debtors are pretty well thinned out, and as for the remaining sinners they might as well be turned out of the temple of your trust.

The first series is a mild type of printed reminder:

PAYMENT Acct. No. 7553
PAST DUE ....., 1931
To.....
.....

According to our records, your account is now *past due.* You should send in your check promptly to preserve your good credit standing, or explain the delinquency. Kindly look after this *at once.*

This printed form is filled out in duplicate on the typewriter, and the original sent out with the first statement of account as soon as it shows up delinquent. If nothing happens, in ten days the duplicate copy of this slip automatically turns up to remind him to send out Form No. 2, which is another printed form, thus:

TWO REMINDERS

That Your Account Is Now Boiling Over! And your co-operation in paying up now will assist in reinstating your account among the *prompt pays.*

A Duplicate of Your Last Statement of Account is also enclosed to remind you of the exact amount now due.

Kindly Send in Your Check by Return Mail, and greatly oblige.

If nothing is heard from the debtor in the next ten days, out goes Form No. 3, which is another printed reminder and includes a blank check, dated and made payable to the veterinarian in the amount exactly due, so that all the delinquent has

to do is to fill in the name of his bank and sign the check:

IF YOU HAVE MAILED YOUR CHECK JUST THROW THIS AWAY

But if You Haven't Just Fill in and Sign the Enclosed Check and Drop It in the Nearest Letter Box TODAY.

On the left of this form is a picture of a letter box, on the right is a picture of a wastebasket, with a red arrow leading to it from the heading, "throw this away." Red lightning, darting out of black clouds under the reading matter "letter box today" on the center of the form, is flashed to the left and in the direction of the letter box.

It has been well said that a good picture is worth 10,000 words, and this graphic reminder certainly proves very effective. Illustrated requests for payment of overdue accounts, like this one, lend a friendly touch to dunning methods, and get under the skin quicker than just an ordinary drab mimeograph, multigraph or printed form, no matter how cleverly it is worded.

But, if nothing happens again in the next ten days, personally written letters are then used, as printed forms are no longer considered of value, and this letter goes out:

For some reason or other, possibly because apples first grew on trees, our ledgers have developed into a roosting place for bills. We have a number of Little Bills, Big Bills, New Bills, Long Bills, Short Bills, Old Bills and Young Bills on our books.

The bills apparently have just accumulated and while they do not represent anything to actually worry about, I feel that they should all be attended to before they all get to be nothing but OLD BILLS.

One of these bills is yours!

Why not send us some green and gold bills in Uncle Sam's currency, for this Old Bill, and help us clean up the roost? We would surely appreciate it! May we count on you—by return mail, please?

If no results follow from this letter, the "pin" letter is now used to prick them into action:

Here is *"The Magic Pin!"*

Looks like the common garden variety, but it can work wonders!

Here's how—

Business is an exchange of commodities. Money is the medium of exchange. A check is a convenient method of transferring money. You owe us $..... Here is your bill—also a blank check, filled out, dated and everything. All you have to do is to sign your name and fill in the name of your bank—

Then take out this Magic Pin—(pinned lengthwise here), and pin them all together, insert in the enclosed envelope and drop them into the nearest letter box today. That will not only put you at ease, but it will also put us out of our misery.

Meanwhile, of course, results are flowing into the till; the reminders alone have been known to pull as high as 50% returns on all outstanding accounts, because they only had to be "reminded," while the balance needed to be "nagged," and so the first letter wakes them up and bags about 15%, while the second letter corrals 10% additional. Since the balance who do not respond are "hard nuts" to crack, the remaining two letters of this series now tighten up their grip on the client's pursestrings:

Gladstone said he never could do a thing until he had to. Some debtors can't see their way clear to pay their debts until they must.

You have not paid your account, nor advised me when you could pay it, in spite of three reminders and two personal letters.

Now your *credit standing* will be seriously impaired unless you send us your check *by the 15th.* I'm not going to write you any more letters or send you any more reminders—the 15th is absolutely the deadline.

Naturally, the veterinarian is now nearing the end of his rope, and if the debtor does not now pay up, he takes just one more long, last and final chance with this letter:

Let's sit down and talk this thing over. You, no doubt, want to pay us and we want to see you get this account out of the way. You have other obligations, no doubt. You can't pay them all at once. But we can help you pay this one off. Let's get together and discuss the matter.

But if you fail to reply to this letter as you have in the past, I'm going to file suit *on the 30th* and obtain a judgment against you. Surely you don't want this sword suspended over your head?

Then why not come in and let's talk this thing over in a friendly way while yet there is time. I'm sure you've got some reasonable excuse to offer and I'll be glad to make all reasonable allowances in your behalf.

I'm waiting—until the 30th—no longer!

Of course, this is the straw that breaks the camel's back and into suit the account goes if the debtor is worth it, and a judgment is obtained. If not worth a judgment, the account is turned over to one collection agency after another to hound the debtor till his death.

Hemorrhagic Septicemia*

By J. F. DE VINE, Goshen, N. Y.

HEMORRHAGIC septicemia, commonly called stock yard fever, or shipping fever, while probably more prevalent a quarter of a century ago than was recognized, has become, during the past decade, truly a menace to the livestock industry.

The fact that cattle, particularly dairy cattle, are moved far more than they were in times past is, no doubt, a contributing factor, but fortunately with all this has come a better knowledge of the disease. Veterinarians are becoming more acquainted with its vagaries and it is diagnosed more promptly than it was a decade ago, so that where proper measures of prevention, in the case of well animals, and proper treatment, in the case of the sick animals, are instituted, the losses may be reduced or entirely prevented in most cases. But, where proper precautions are not taken as to the biologics used and the methods of use, the disease may run rampant.

I have repeatedly seen so many unnecessary losses that it has prompted me to condemn rather positively carelessness in the prevention and treatment of this disease.

In 1885, Kitt studied an epizootic in cattle and swine in Sinebach. According to Moore, Kitt isolated a short, polar staining, non-motile, rod-shaped organism fatal to cattle, horses, pigs, sheep, goats, dogs and rabbits.

Later Hueppe proposed the name Bacillus Septicemiae Hemorrhagicae for this group of organisms, and Septicemia Hemorrhagica for the disease they produced.

Text books written some time ago did not give as clear a picture of the various manifestations of the disease as they might have. For instance, here are the symptoms usually cited in the text books:

"In the acute Septicemia type of the infection there is a rapid onset of the disease. Temperature 104° to 106° F. Death may occur in 6 to 30 hours. In subacute or chronic form the symptoms vary, depending upon the severity and principle localization of the infection.

"In the pectoral or pulmonary form it is characterized by symptoms of an acute pleuro-pneumonia, with a dry painful cough, nasal discharge, inappetance, and when caused to move, the animal exhibits distress, a marked stiffness, and may actually appear to be lame. In the chronic form, emaciation is marked.

"In the intestinal form digestive derangement is pronounced, constipation, later diarrhea, is noted. The feces are frequently blood stained, and the urine may be tinged with blood. A marked tenderness over the abdomen is observed on palpation. Rapid emaciation and death in two to four weeks.

"In the subcutaneous or edematous form there is marked local inflammation and swelling about the head, throat, legs and shoulders, and even throughout the muscular system, and death within 24 to 48 hours. When these swellings are incised, they are found to contain an inflammatory serous exudate.

"In the cerebral or nervous form the animal is restless, hard to control, butts against objects, intense itching and scratching, often lacerating the skin. This form is often referred to as 'mad itch.' On the other hand marked dullness and depression may also indicate the cerebral type."

Many of us now know that the temperature frequently reaches 108° F. in the acute cases and we have seen animals bleed from the nose and the anus very similar to what we observe in acute anthrax.

There are a few things we must ever

*This is a synopsis of the discussion at the 11th Annual Eastern States Conference on Tuberculosis and Other Animal Diseases, held at Albany, N. Y., June 3-5, 1930.

keep in mind in the case of adult cattle. Usually if we get the exact history, the cattle have been moved recently, or rather recently, or they have been in contact with cattle that have been moved. This does not necessarily mean by railroad cars or boats. The most acute case I ever saw had been moved by motor truck, landing at the farm in the morning after a 200 mile run and dying that evening.

I would like to draw the attention of my colleagues particularly to the symptoms in calves, because not long since, while in consultation with a very capable practitioner in one of the New England states, I found that the calves on a certain farm were dying in spite of all the medication this faithful man could give them. They were suffering from hemorrhagic septicemia, but resembling in many ways a mild form of lead poisoning. Thousands of calves die every year from this infection without its being diagnosed, many regarding it as lead poisoning, colds, indigestion and so forth. This is largely due to the fact that symptoms vary so widely. Whenever there are unusual deaths among calves always think of hemorrhagic septicemia. Death may be so sudden as to be preceded by practically no symptoms at all; calf all right at night and dead in the morning, or it may come on in an acute form and appear like pneumonia, or may be manifested in a sub-acute type with nasal discharge and digestive disturbances.

Preventive measures, when properly applied, are most satisfactory. Preventive inoculations, in the case of this disease, are about as specific as anything we know of.

Aggressins may be used, if used sufficiently in advance to insure immunity before exposure or movement of the cattle. We must ever keep in mind that aggressins have no curative value and that they may lessen resistance for a period and, if the animals are moved or exposed and become sick, soon after the administration, that aggressins so aggravate the condition as to make it impossible to save many animals that might otherwise have been saved.

To quote F. A. Imler, Kansas City, Kansas, Inspector in Charge, Virus Serum Control, Bureau of Animal Industry, U. S. Department of Agriculture:

"The nature of aggressins is not fully understood. However, there is strong evidence to show that they may be endotoxins liberated by the breaking up of the micro-organisms. They belong to a group of biologics which produce an active immunity or a type of immunity which does not develop until several days after inoculation. The period following treatment with an aggressin or germ-free exudate before immunity is established is rather indefinite, but as a rule it requires from ten days to two weeks. During this period, treated animals are highly sensitive or susceptible to disease caused by organisms or germs of the same species as those used in the preparation of the aggressin with which treated.

"Aggressins have no curative value and their use is indicated only in those cases where the animal is in normal health and will not be exposed to a natural or an artificial infection for from ten days to two weeks after treatment."

Some ask the question as to the use of aggressin and serum, that is, giving a large dose of serum when the aggressin is given and, if the animals must be moved or exposed in a few days, say give them a large dose of serum every day for three or four doses. This is a good theory. We have no information as to how practical it is. Then another thing, to give 50 to 100cc of serum every day for a few days is rather costly.

Another method of prevention is the use of bacterins, either hemorrhagic septicemia (all species) or mixed bacterin (bovine). A bacterin when given often enough and in doses large enough, has positive immunizing value. In addition to this, it stimulates anti-bodies, almost immediately, consequently has curative properties. So, instead of being injurious, should an animal need to be moved

or exposed, within a few days, bacterins have positive merit, either in preventing the illness or in mitigating it, if the animal is sick.

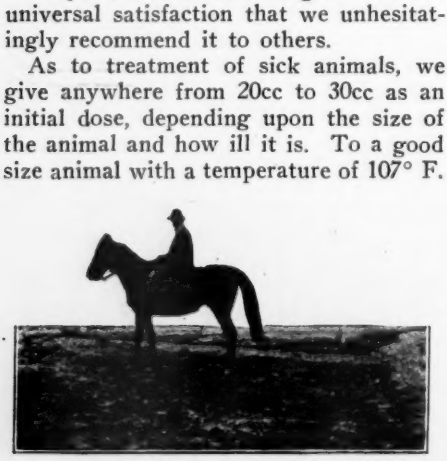
The approximate dose for immunizing a mature bovine, depending upon the weight and age of the animal, is 2 to 4cc of an agar bacterin as the initial dose. The second dose, which should be double the amount of the first one, may be given in 3, 4 or 5 days, and the third dose, which again should be double the amount of the second dose, may be given from 6 to 8 days after the second.

Here is the way we handled shipments for years and, when our suggestions are followed, the results have been almost 100% good.

In mature cattle to immunize we give 4cc of an agar bacterin as an initial dose. If a shipper can get his cattle together so as to give the second dose on the third day, we do that. If the animals are to be shipped at once and are to be on the road for 3 or 4 days, we give the second dose just as soon after they arrive as practicable and, unless the cattle are distributed at once, they receive the third dose 6 or 7 days later. However, occasionally we find circumstances where it is necessary to shorten the intervals between doses. There is no positive objection to this.

I repeat, this method has given us such universal satisfaction that we unhesitatingly recommend it to others.

As to treatment of sick animals, we give anywhere from 20cc to 30cc as an initial dose, depending upon the size of the animal and how ill it is. To a good size animal with a temperature of 107° F.



and breathing hard we give 30cc and repeat in 12 hours, unless there is a pronounced improvement. If there is a pronounced improvement we make the dose perhaps 15 or 20cc, and if improvement continues we follow with a 10cc dose daily for a few days. We are not concerned about giving the animal too much. It is simply a question of occasioning as little expense as is practicable and safe.

The animals that are not so sick receive smaller doses, perhaps 10 or 20cc, and the exposed animals receive around 5cc every couple of days.

In the case of calves, the treatment is practically the same, except where we can we add a dose of serum and make the dose of bacterin about 4cc, increasing it up to 10cc if the case is not responding. However, in the prevention of this ailment in calves, as well as in infectious white scours, we occasionally have found it an advantage to treat the dam with bacterins during the last two or three months of pregnancy, in order to save the calf crop. I have reported in veterinary literature, from time to time, where it was necessary to follow out a special regime.

SANTONIN A SPECIFIC FOR ASCARIDS

Experiments with certain anthelmintics carried out on some 400 animals allow the following conclusions to be drawn: Santonin and its derivatives are specific anthelmintics for ascarids, and the therapeutic doses are much smaller than the lethal doses. The dosage of santonin for dogs, cats, and pigs requires revision in the sense of increasing the doses. The efficiency of santonin depends less upon the dose than upon the laxative given with it and the manner in which it is given. Santonin is least effective against the ascarids of horses, but this drug removes a considerable proportion of the strongyles. Carbon tetrachlorid is to be considered as the most effective anthelmintic against the equine strongyles.—Schulz, Moscow, at the Inter. Vet. Cong.

MILK AND HEALTH

THE health and physical vigor of any nation depends largely upon the abundance and quality of its food supply. Every progressive sanitarian will agree that no country can be prosperous or contented or virile if the people are hungry and malnourished. You can not raise a first rate population on a third rate diet, for civilization advances only as human nutrition is efficient and adequate.

The quality of a national food supply is measured to a considerable degree by the amount of pure milk which it includes. As President Hoover once declared, "upon the dairy industry, more than any other of the food industries, depends not alone the problem of public health, but there depends upon it the very growth and virility of the white races."

In milk we have a finished product containing practically all of the elements needed to nourish and sustain the human body. It is the one food for which there is no single substitute, the one food which is indispensable to the welfare of the race. These are facts conceded by all physicians, all health officials, and all authorities on nutrition.

In declaring that milk is our most nearly perfect food, we refer, of course, only to milk which is both clean and safe. Milk may be, unfortunately, a suitable nutriment for germs as well as for man, a fact shown by the too numerous outbreaks of disease which have occurred in various parts of the country when milk supplies have been contaminated by careless handling.

Our friend, the cow, has been extolled in song and story. This is no more than her due, for throughout the ages the cow has made a real contribution to the progress of civilization. Those nations which have subsisted chiefly on dairy products have always been the most vigorous and long-lived. The conquerors have been the pastoral peoples who have had many cattle and who have been lavish in their use of their products.

The popularity of milk always has been enhanced when the public has had confidence in its purity. With the more universal adoption of methods which can guarantee the cleanliness and safety of our market milk supplies, such as it has been our privilege to put into operation here today, milk will properly become the national drink, a food used in adequate amounts in every home, and one of the greatest factors in the promotion of our national health.—Dr. S. J. Crumbine in *Hoard's Dairyman.*

Statisticians list 205 separate and distinct causes of death, but eight of these causes do two-thirds of the mischief. They are: Heart disease, cancer, pneumonia, nephritis, cerebral hemorrhage, accidents, tuberculosis and hazards of infancy. The chances are two to one that the average person will succumb to one of these eight destroyers.

Equine infectious anemia according to Opperman, is transmissible to the fowl by injection of blood containing the virus. The virus produces changes in the liver of the fowl. It has also been demonstrated that the virus from the fowl (blood, tissues, etc.) is capable of producing the disease when inoculated into suspectible horses.—*Exp. Sta. Rec. 62,* 6.

MILK BORNE EPIDEMICS

Contaminated milk caused 44 epidemic outbreaks of illness in the United States and 4 in Canada during 1929. Those in the United States involved 1,959 cases and 48 deaths while the 4 epidemics in Canada embraced 37 cases of illness and 3 deaths. Three of the United States outbreaks, involving 143 cases, were in Illinois.

While it is deplorable to experience any sickness whatever from the use of milk, the record last year is a remarkable tribute to the milk producers, the milk dealers and the sanitariums in this country. With milk drawn from about 22 million cows and consumed by upwards of 100 million people, there were only 1,959 individuals, about 3 in each 2 million who were reported to have been made ill by contaminated milk.—*Illinois Health Messenger.*

Milk Inspection in a Small Town*

By W. H. HILTS, Elko, Nevada

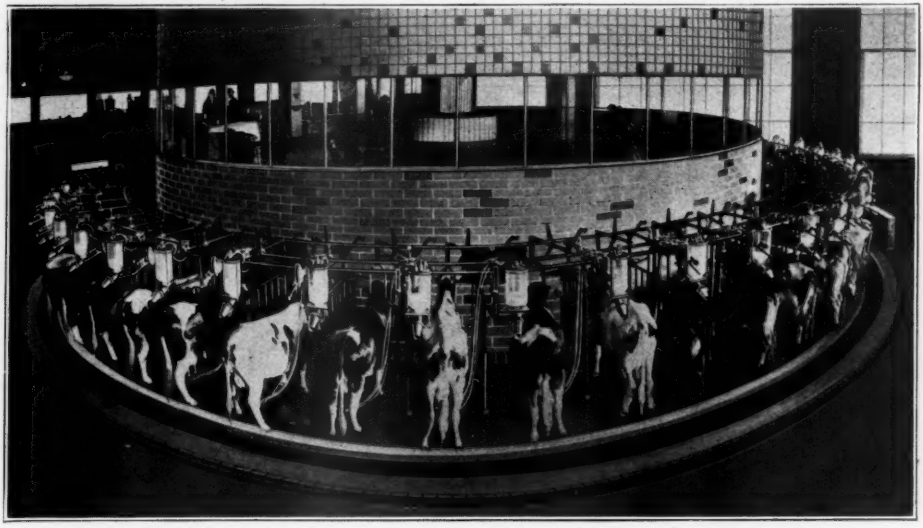
FOR the past six years the City of Elko, Nevada, a small town of about 3,000 population, has maintained a regular system of milk inspection. Previous to 1922 there was no regular inspection. Once or twice a year an inspection was made by the State Department of Pure Food and Drugs. This inspection helped to some extent but was not frequent enough to be adequate. The quality of the milk at that time is not known to the writer, but he has been told that sour milk was not uncommon, complaints were many, customer turn-over was large and consumption of milk was small, especially in the summer months which are less favorable for good milk. Since regular milk and dairy inspection have been established all this is a thing of the past.

The event directly responsible for the establishment of milk inspection in Elko was the finding of sixteen tuberculous cows in a herd of twenty-three cows supplying the city with raw milk. This event forcibly impressed upon the people of the city the necessity for frequent and constant supervision of the milk supply. It so happens that one of the milk distributors of the city is a graduate veterinarian. By reason of his knowledge of both the veterinary profession and the dairy business he is unusually well posted on the many advantages of milk inspection. As a veterinarian he knew that milk inspection would protect the health of the people to a great extent and as a milk distributor he knew that anything that built-up the quality of the milk would also build-up his own business. He recognized that the finding of this large number of tuberculous cows had focused the attention of the people on their milk supply and that conditions were ripe to start agitation for city milk inspection. Largely through his individual efforts a model ordinance was procured from the State Department of Pure Food and Drugs, submitted to the city council and promptly passed. Immediately following passage of the ordinance arrangements were made with the State Board of Stock Commissioners to have the writer, who is an employe of that Board and stationed at Elko, take on the work. It was estimated that the work would require about two days time per month, and the city agreed to pay the Board $25.00 per month for the service. Equipment was purchased, arrangements were made to do the milk testing in the laboratory of the County hospital where a microscope and incubator were available, and the work started. With very few exceptions it continues today as it was when it was first started.

The milk supply and the dairies are inspected at irregular intervals, usually about once a month but oftener if necessary. More attention is given to the work in the spring and fall as they are the critical times in milk production. Dairies are inspected and scored more or less in accord with the U. S. Department of Agriculture score card and with the Department Circular 276 entitled "Inspection of Milk Supplies," special attention being paid to the sterilization of milk containers and to the cow's udders. Milk rooms, entirely separated from the barns, small top milking pails and milk coolers are insisted upon although the coolers are not always used during the very cold winter months when temperatures go down to zero or below. Well ventilated and well lighted modern barns and many other things are very desirable, but they are not considered nearly as important as the other things just mentioned. It is required that dairy cattle be tuberculin tested annually and reactors immediately removed and slaughtered.

* Presented at the Intermountain Live Stock Sanitary Association, Ogden, Utah, January 9, 1929.

Milk samples for testing are obtained from the delivery wagons. The milk is tested for butter fat, solids not fat, total solids, added water, sediment and a bacterial estimate is made. Tests are also made for adulterations, and preservations when they are suspected. All of these tests are quite simple and can be made by any veterinarian with little special preparation or equipment. The routine of testing milk samples is as follows: The samples are taken from the delivery wagon without any previous notice to the dairy or driver. If the sample does not feel cool enough to the touch, two samples are taken and the temperature of one of them is ascertained on the spot. The other sample is placed on ice and taken to the laboratory as soon as possible. Immediately on arrival at the laboratory, and without removing the cap, the milk is mixed as thoroughly as possible by inverting the bottle several times and by shaking it. The cap is then removed and 10cc of milk are taken with a sterile pipette for the bacterial estimate. For making this estimate the reductase test is used. Formerly, the plate method was used for making bacterial counts, but for several reasons this method was discontinued in favor of the reductase test. The latter is very simply made and, while it has its disadvantages just as other methods have, still it is accurate enough for practical purposes. The technique for making this test may be found in New Hampshire Agricultural Experiment Station Circular 23, June, 1924. In addition the reductase test samples are examined microscopically when it is considered necessary.

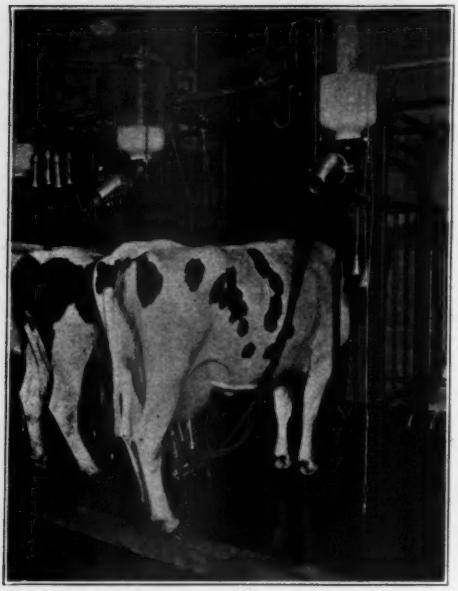


View of the Rotolactor, described last month, page 41, a revolving circular table 60 feet in diameter and containing fifty stalls in which cows are washed, dried and milked while they make one complete revolution, which requires 12½ minutes. It is an appliance just recently installed at the Walker-Gordon Laboratories of the Borden Research Foundation. 1680 cows are milked on this appliance three times daily. It is a herd producing certified milk for distribution in New York City. The table turns continuously and one cow is constantly entering upon it for a 12½-minute ride and another cow always leaving it to return to her place in the cow barn. It is believed to be a big advance in sanitary methods of milk production.

The sample is then warmed to about 60° F., thoroughly mixed by pouring, and the lactometer reading is taken. Then the sample is again mixed and the Babcock sample is taken. The remainder of

the milk in the bottle is then forced through the sediment tester. The cotton disc containing the sediment is removed, marked and mounted. The Babcock test for butter fat is then completed. This completes the actual examination of the milk unless it is considered advisable to make further tests for preservatives, etc.

The "solids not fat" content is computed from the butter fat content and the lactometer reading by means of a per-



Close-up view of the Rotolactor. The milk goes from the cow's udder to the glass jar above without exposure to the air or contamination.

centage table that is found in Klein's "Principles and Practice of Milk Hygiene" and other texts.

When the lactometer and butter fat readings point toward a possibility of added water in the milk the percentage of added water is determined by using the following formula: Lactometer reading, plus butter fat content, multiplied by 100, divided by 34.5 equals x. 100 minus x equals percentage of added water. This formula is not exactly correct, of course, but will detect any appreciable amount of added water.

Following completion of the examination a permanent record of the results is made and a certificate stating the results of the examination is sent to the dairyman. In case violations of the ordinance are detected, a copy of the certificate is sent to the City Clerk and immediate steps are taken to locate the cause of the trouble and to remove it. In many cases, the dairyman is unaware that there is anything wrong with his milk and in such instances he very much appreciates the helpful assistance of the inspector. After the dairyman has been given a reasonable amount of time to bring his milk back to standard, it is again tested. The second test practically always shows that the milk is back to standard. To date it has not been considered advisable to prosecute any of our dairymen for violations of the milk ordinance. Violations are frequently detected but in practically all instances they are mistakes of the hand rather than of the heart and no prosecution is indicated. We believe, however, that when a dairyman proves himself to be negligent and indifferent to the quality of his milk he should be promptly and permanently put out of the business. This may be done either through the courts or by public opinion. We prefer public opinion as our experience has twice shown us that this method works swiftly and surely in a small community. Court actions frequently only start trouble whereas the judgment of public opinion is final.

We believe that the City of Elko, Nevada, has demonstrated that any organized community, large or small, can have regular and efficient milk inspection at small cost, provided only that the services of a veterinarian are available.

This is about all there needs to be said at this time regarding milk inspection in Elko. But there is a great deal that may well be said about the lack of milk inspection in the other towns in this region. There is nothing surprising about what has been done in Elko. The surprising thing is that it has not been done in other

places. Probably one reason why more communities do not have milk inspection is on account of the prevailing belief that this work requires highly trained specialists and that the work is too expensive tor small communities. Both of these ideas are erroneous. Any practicing veterinarian is already at least 75% qualified to do the work and with very little additional study and application can easily quality himself to do very efficient work. The veterinarian is the key to the situation and where one is available, even for part time service, the community can have regular milk inspection.

As far as the cost is concerned, it amounts to practically nothing. In Elko the annual cost to each inhabitant is about the same as the cost of a quart of milk. Certainly 12 cents per year per person is no obstacle to regular milk inspection.

The entire benefits of milk inspection are much greater than is generally known. It benefits, not only the consumer but the dairyman and the veterinarian as well. The beneficial results as a public health measure are well known to a group of this kind and need not be repeated here but the beneficial results to the dairymen and to the veterinarian are not so well known and may well be brought out at this time.

In places where milk inspection has been established the better dairymen are always enthusiastic supporters of it; not altogether from a health standpoint but also from a business standpoint. Many of the larger milk distributors have milk inspectors on their payrolls because they have learned that milk inspection leads to better milk, better milk always means more milk used and consequently more business for the dairymen. According to the last report of the Nevada State Pure Food and Drug Commissioner, Elko has the highest per capita consumption of market milk in Nevada. Dairymen also profit considerably through the advice given them by inspectors in regard to animal health and dairy sanitation. They appreciate greatly the regular analysis of their milk and cream. This is particularly true of the small dairyman who is hardly in a position to make this analysis for himself. The milk inspector is the dairyman's best friend.

Just how shall one go about it to get this kind of work started? There are many things that can be done but the first, and most important is to familiarize yourself as much as possible with the work so that you will be prepared when the demand comes for your services. The demand will surely come as soon as the proper foundation has been laid. The veterinarian can be very instrumental in laying the foundation for this demand but in most instances he should keep himself in the background lest he be accused of trying to feather his own nest and thus prejudice some against the whole proposition. Newspapers, county health officers, and others can be of considerable assistance. Various Federal and State agencies are always glad to assist in work of this kind and model ordinances can be obtained from them. A survey of the milk supply of the community made by the proper state official or other competent outsiders usually furnishes information that is valuable for a starter.

One more suggestion: In your campaign for clean milk, while you are proclaiming the dangers and disadvantages of unclean milk, do not forget to proclaim the advantages of clean milk.

In closing, let me quote Dr. Woods Hutchinson, a physician and eminent writer on public health matters, who said:

"A pure and wholesome milk supply will not come of itself, nor will it continue a moment longer than inspection is maintained. Eternal vigilance is the price of liberty—from milk borne infections and money spent in maintaining proper milk control is the soundest of investments for it will repay itself, year after year, in the health of the growing generations."

The Nature of Milk Fever

By J. RUSSELL GREIG, Ph.D., M.R.C.V. S., Edinburgh, Scotland.
Director, The Moredun Research Institute

MILK Fever has been well named "The Disease of Theories." Since rather over 100 years ago, when it was first recognized as a clinical entity, it has constantly intrigued the attention of veterinarians throughout the world, and has perhaps given rise to more speculative hypotheses upon its cause and nature than any other disease in veterinary medicine.

The hypotheses may be classed under the following heads:

General Inflammation;
Derangements of the Nervous System;
General Circulatory Disturbances;
Cerebral Anemia;
Cerebral Congestion;
Apoplexy;
Thrombosis;
Fat Embolism;
Spinal Traumatism;
Aeremia;
General Microbic Infection;
Bacterial Infection of Uterine Origin;
Bacterial Infection of Mammary Origin;
Anaphylaxis;
Mammary Neurasthenia;
Avitaminosis;
Anhydremia;
Auto-Intoxication.

While speculative controversy raged, there appears to have been a curious lack of application of the experimental method for the confirmation or refutation of any of these hypotheses. Practitioners were still left without any reliable guide to the treatment of the disease and, while various treatments from time to time found a measure of favor, no real advance was made. The year 1897, however, marks an epoch in the history of milk fever, for in that year, J. J. Schmidt, a veterinary practitioner in Kolding, Denmark, reached certain conclusions in his investigation of the disease, which in their application yielded remarkable results.

It will be remembered that at that period bacteriology was becoming increasingly recognized as a science capable of elucidating the nature of diseased conditions. Many diseases were yielding to investigation by bacteriological methods.

It was natural that Schmidt should consider the disease as a bacterial infection, and since it was obvious that the malady was closely related to milk secretion, he considered that the udder was the seat of microbic invasion. To test his hypothesis, he subjected the milk of affected cows to microscopic examination, and he discovered what he believed to be evidence of cellular disintegration and concluded that some ferment or toxin within the udder was responsible for the degeneration of its lining epithelium.

Actually what Schmidt mistook for degenerated cells were normal elements and had he controlled his observations by examining the colostrum of healthy cows, he would have obviated making a false observation.

It is extraordinarily fortunate that he did not do so, for having convinced himself that some living pathogenic agent was present in the udder, he proceeded to inject into the gland a solution of iodide of potassium, which was then believed to possess antiseptic properties. We know today that iodide of potassium is devoid of antiseptic action.

We can imagine with what joy Schmidt noted the response which followed this new treatment. Case after case recovered. He quickly communicated the results of his investigations to his brother practitioners, and the practice of the Schmidt treatment rapidly extended and eventually became general.

Schmidt has been rightly regarded as one of the pre-eminent benefactors of the dairying industry.

Later it was found by Andersen of Skanderborg and others that inflation of the udder with atmospheric air, as distinct from injection with antiseptic fluids, was even more effective, and was less likely to be

attended by mammitis, and so, by an extraordinary series of false observation, erroneous inference and misguided choice of remedial agent, we had discovered to us a method of treatment as spectacular surely as any throughout the whole range of therapeutics.

But, while the discovery of this specific treatment gave rise to fresh ideas as to the nature of the disease, our knowledge of the essential pathology of milk fever was not advanced. The very simplicity and specificity of the mysterious treatment rendered the nature of the disease all the more obscure. That milk fever should have been the object of continued interest is not surprising when we consider the dramatic features which attend it.

We are presented with a case in which a cow in prime condition and apparently perfect health passes successfully and without mishap through a perfectly normal physiological crisis, i.e., parturition. Whereupon she is suddenly struck down with a serious malady from which she, in all probability, will die unless she be subjected to a mechanical procedure quite ridiculous in its simplicity, whereupon she makes a recovery almost as rapid, and certainly as dramatic, as was the onset of the ailment.

I confess that, personally, I have always possessed a keen appreciation of the dramatic, and I can remember very vividly how my imagination was stirred on encountering and treating, as a young student, my first case of milk fever. It seemed to me that if we could only gain a true concept of the nature of this mysterious malady, or alternatively, if we could comprehend the means whereby simple inflation of the udder produced its remarkable effect—if we could only read the riddle aright—we would have granted to us a new vision of pathological process. Since that time milk fever has been to me an entrancing problem.

In 1924 I, in collaboration with Professor Henry Dryerre of the Royal (Dick) Veterinary College (now Physiological Biochemist at the Moredun Institute) attempted the serious investigation of the problem, and as up to that time none of the experimental investigations had afforded any clue to the nature of the disease, we considered that a fruitful line of enquiry might be obtained by first submitting the whole matter to a process of reasoning.

Commencing with the fact that specific cure resulted, no matter whether antiseptic fluids, sterile water, oxygen or air were injected into the udder, it seemed obvious that the curative effect, whatever it might be, depended upon the mechanical distention of the mammæ.

We then premised that simple distention of the mammæ must act either:

a by causing some endocrine disturbance and/or

b by mechanically retarding or arresting milk secretion, and so preventing the loss in the milk of some substance vital to the organism.

That the disease was in some way closely associated with milk secretion was suggested by the facts that:

1. Its appearance as a clinical entity was coincident with the commencement of the development of the modern heavy milking strains.

2. It was much more prevalent in dairy breeds than in beef breeds.

3. It very commonly attacked those individuals which possessed specially heavy milking qualities.

4. The period of greatest susceptibility in the milking life of an individual cow corresponds to the period of greatest milk secretion. Primipara were very rarely affected.

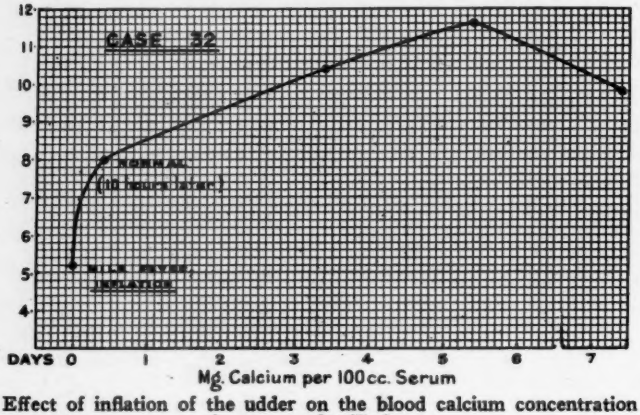
5. The rapid emptying of the udder by hand might precipitate the onset, while the practice of repeatedly removing small quantities of milk or, alternatively, of permitting the calf to suck the cow for the first few days after calving, was recognized as a valuable preventive procedure.

The milk cow has been bred to produce an enormous quantity of milk; indeed, the quantity of her milk secretion may now be regarded as almost pathological.

The colostrum of the cow is rich in calcium, and it was considered likely that the onset of a profuse lactation might occasion a rapid reduction in the concentration of the

blood calcium. This idea seemed to be supported by our further observation that the spastic seizures which often characterize the early stages of milk fever were tetanic in character.

We believed that the mere mechanical withdrawal of calcium from the blood as the result of the onset of a profuse secretion of milk could not in itself be regarded as the cause of milk fever, because if this were so every heavy milking cow would be subject to the disease. For that reason we postulated that some other factor must act as a predisposing cause, and we suggested that such might be found in parathyroid dysfunction. As is well known, the parathyroid possesses among other functions that of controlling the level of calcium in the blood and soft tissues.



Effect of inflation of the udder on the blood calcium concentration in a case of milk fever

The following, then. were the essential points in our hypothesis[1]:

1. The nature of milk fever may be understood as a parathyroid deficiency, resulting in the accumulation of toxic substances, such as guanidine; and a fall in blood-calcium, the fall in calcium being further accentuated by lactation.

2. The curative effect of mammary inflation is due to

a the stimulation of adrenal secretion and the consequent oxidation of toxins and/or

b The retardation of the formation of milk and the consequent prevention of further free exchange of calcium from the blood to the milk.

3. The preventive value of a restricted withdrawal of milk from the udder after calving is due to this procedure conserving the concentration of calcium in the blood.

If our conception of the nature of the disease were correct, then it followed that the blood-calcium in milk fever should be below normal (hypocalcemia). Analyses of seven samples of blood from as many cases of milk fever showed an average of 4.8 mgm. calcium 100cc serum; a marked reduction when compared with the normal — 9 mgm. to 11 mgm. per 100cc of serum.

While our subsequent work has amply confirmed our original view that acute calcium deficiency was an important factor in the production of the disease, there is now reason to doubt whether the accumulation of guanidine bases plays an important part in its causation.

Our original view that mammary inflation possibly stimulated the secretiton of adrenalin may also now be abandoned in view of the carefully conducted experiments of Auger,[2] who was unable to note any rise in blood-pressure following inflation of the udder.

Later, in 1925, Little and Wright[3] recorded the results obtained in blood-calcium determinations on twelve cases of milk fever. They showed that a considerable diminution in the blood-calcium (in mild cases 20% to 30%, and in severe cases up to 60%) accompanied the onset of the disease, and they

[1]Dryerre, H., and Greig, J. R., *Vety. Rec.*, 1925, V, 225..

[2]Auger, L., Researche "Sur . . . Fievre Vitulaire et le Syndrome Hypoglucemique." Monograph, 1926, Lyons, p. 81.

[3]Little, W. L., and Wright, N. C., *Brit. Jour. Exp. Path.*, 1925, VI, 129.

also found that the greater calcium reductions accorded with the more severe cases.

These and our own experiments therefore furnished considerable support to our hypothesis, and further work has amply confirmed the original conception that calcium deficiency is the primary cause of the disease.

Fish[4] and Sjollema[5] have shown that a deficiency in the blood-phosphates usually, but not invariably, also occurs in milk fever.

The significance of the phosphate fall is yet to be determined, but that it should commonly occur in milk fever is not unexpected, since the metabolism of calcium and that of phosphorus are so closely bound, and since it is believed that calcium occurs in the blood as the tertiary phosphate.

The results of our experimental work may be summarized briefly as follows:

1. There is no difference between the calcium values in parturient cows and those in non-parturient cows and in bullocks.

2. The onset of milk secretion is accompanied by a transient but appreciable fall in the blood-calcium, which returns to normal after the crisis of initiation of lactation is passed.

3. In milk fever there is invariably a pronounced fall in the blood-calcium (82 cases examined). The degree of severity of the symptoms bears a distinct relation to the calcium level in the blood. From a series of observations made in one case, before and during the attack, the fall in calcium appears to be abrupt; it is coincident with the onset and corresponds with the progressive severity of the symptoms.

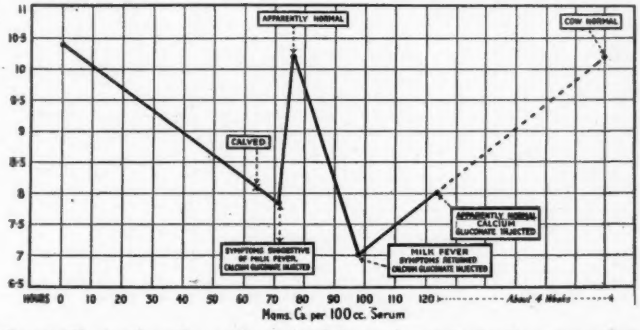
4. In an examination of 81 cases of diseased conditions in cattle other than milk fever, none was found to present a hypocalcemia in any way comparable to that which obtains in that disease.

5. Inflation of the mammæ of normal lactating ewes causes a rise in the blood-calcium (about 10%).

6. Inflation of the mammæ of the cow in cases of milk fever results in a pronounced rise in the blood-calcium. The rise is at first rapid, and the case usually shows definite signs of recovery when a level of about 6 to 7 mgm. of calcium per 100cc has been reached.

7. Injection of calcium gluconate, exclusive of other treatment, elicits specific curative response in milk fever.

8. The subcutaneous injection of calcium gluconate can abort the milk fever attack. Evidence has been obtained which suggests that calcium injection immediately after calving and preferably reinforced by a second injection about 24 hours later would prove a preventive treatment.


APPARENTLY NORMAL
COW NORMAL
CALVED
APPARENTLY NORMAL CALCIUM GLUCONATE INJECTED
MILK FEVER SYMPTOMS RETURNED CALCIUM GLUCONATE INJECTED
HOURS 0 10 20 30 40 50 60 70 80 90 100 110 120
About 4 Weeks
Mgms. Ca. per 100 cc. Serum

Graph illustrating the action of calcium gluconate in the prevention of milk fever

9. The repeated oral administration of massive doses of vitamin D has been found to cause a marked rise in the blood-calcium which can persist for about five days.

The observation suggests that the disease may also be prevented by this mean by commencing the administration of vitamin D a few days before calving.

10. The blood-calcium values of normal sheep were observed. It would appear the normal variation of blood-calcium is greater in sheep than in cattle.

The association of acute hypocalcemia

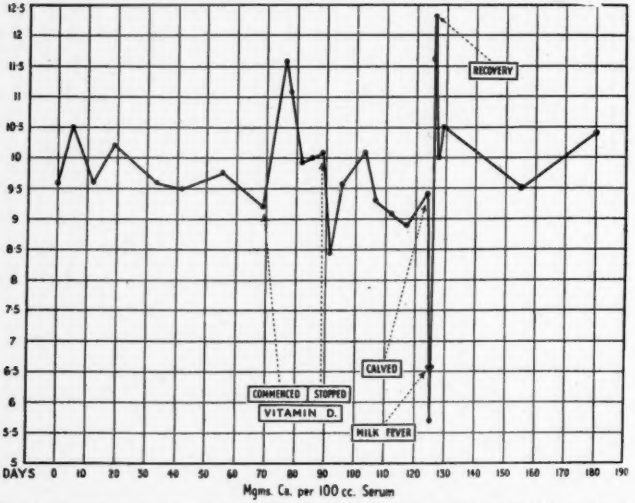
[4] Fish, P. A., *Cornell Vet.*, 1929, XIX, No. 2.

[5] Sjollema, B., *Biochem. Zeit.*, 1928, 300.

with lambing sickness* has been determined, and the identity of this disease with milk fever established.

The known curative effects of mammary inflation in lambing sickness are also correlated with a rise in the blood-calcium values. In many cases the curative effect of subcutaneous injection of calcium has been tested; the treatment has resulted in rapid recovery.

11. The calcium values of normal horses were found to be considerably higher than those of cattle and sheep. In an examination of two cases of transit tetany in mares a pronounced hypocalcemia was found. In one case of transit tetany, mammary inflation, and in the other, calcium injection, was followed by complete recovery.



Graph illustrating the normal fluctuations in the blood calcium level and the effects following the sudden administration of vitamin D. Note the calcium fall during the attack of milk fever

Conclusions

I. *The essential cause of milk fever is an acute blood-calcium deficiency.*

II. *The specific curative action of mammary inflation consists in raising the blood-calcium values.*

These conclusions are based on the following considerations:

1 Milk fever is invariably associated with an acute hypocalcemia.

2. The more severe cases correspond with the lower calcium values.

3. The fall in calcium is approximately coincident with the appearance of the symptoms.

4. Tetany is a symptom in severe cases of milk fever, and the occurrence of tatany is recognized as consequent upon pronounced hypocalcemia.

5. Mammary inflation raises the level of blood-calcium in a normal lactating animal.

6. Mammary inflation elicits a marked rise in the level of blood-calcium in milk fever and cures the disease; the process of cure, as manifested in the disappearance of the symptoms, corresponds with the rise of the blood-calcium.

7. Injection of calcium, exclusive of other treatment, raises the blood - calcium concentration and cures the disease.

8. Milk fever in cows, lambing sickness in ewes, and transit tetany in mares are all rapidly cured by mammary inflation, and these are the only conditions in an examination of over 500 samples of blood in which an acute hypocalcemia has been found.

It has long been recognized that the term "Milk Fever" is a misnomer, and from the foregoing conclusions I would venture to suggest that "Acute Parturient Hypocalcemia" would be appropriate.

When it became apparent that the essential nature of the disease was a calcium deficiency, the writer sought for a form of calcium which could be injected subcutaneously.

* This is not to be confused with the condition in this country known as stercoremia, pregnancy disease, preparturient paresis of ewes, acidosis of pregnant ewes, etc. In this ailment there is not a lowering of the blood calcium level and neither udder inflation nor calcium injection is beneficial.—Ed.

As is well known, calcium chloride is so irritant when injected locally that intravenous injection forms the only means by which it may be directly introduced into the tissues. It was obvious that an intravenous injection of calcium could not be readily applied in all cases of milk fever. Frequently, when the case is comatose the animal is found huddled up in a narrow stall; or during the periods of convulsion, it may be impossible to safely introduce the needle into the vein. Unless the intravenous injection of calcium chloride be perfectly performed and all leakage into the surrounding tissue avoided, abscess formation and necrosis are the almost invariable results.

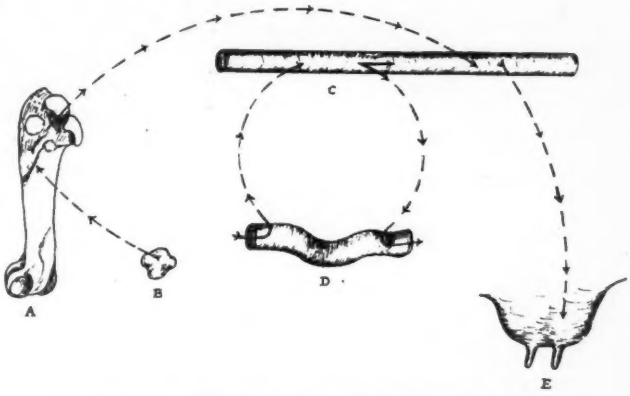
Again, while the direct injection of calcium into the blood stream rapidly raises the blood-calcium concentration, this high concentration tends to fall rapidly. Thus, while the intravenous injection of calcium frequently brings about very rapid recovery, relapses are liable to occur.

After considerable search and trial, it was found that calcium gluconate [Ca $(C_6H_{11}O_1)_2$] could be safely injected subcutaneously and intramuscularly, and with the cooperation of Mr. Oscar Stinson, M. R. C. V. S. of Appleby, Westmoreland, who carried out the early field experiments, the writer evolved a treatment which has since been practiced on a considerable scale in Great Britain.

The calcium gluconate employed is that manufactured by Messrs. Sandoz, and is a neutral organic salt, prepared from calcium and gluconic acid. It contains no sugar, neither can its oxidation produce sugar. On the contrary, the acid radical, from a physiological point of view, is inert, and the action of the salt depends exclusively upon the value of the calcium ion.

The preparation is produced both in the form of granules which are dissolved by the practitioner previous to the application of the treatment, or as an already prepared solution in sealed ampoules. The dosage varies widely and depends upon the severity of the attack. One to three ounces of the granules are dissolved in one to three pints of water. The salt should be dissolved in boiling water to ensure complete solution and, while the solution may be prepared at home previous to proceeding to the case, it is well to filter and reboil it for a few minutes before injection, and to allow it to cool to about 105° F.

The solution is injected in front and behind each shoulder—four points in all—in



A—Bone; B—Parathyroid; C—Blood vessel; D—Gut; E—Mammary Gland

Calcium absorbed from the gut is carried to the blood stream and thence to the tissues. Heavy deposits are laid down in bone. Excess calcium in blood is mainly excreted by the gut. It is assumed that the parathyroid secretion converts the calcium in the bone into a readily assimilable form which is carried by blood to the soft tissues. Calcium being highly concentrated in colostrum, the commencement of lactation suddenly deprives the blood of large quantities of calcium which must be immediately replaced. This is affected by the parathyroid. In the case of parathyroid inefficiency at the commencement of lactation, the rapid loss of calcium in the milk causes an acute deficiency of blood calcium which cannot be quickly enough replaced by mobilization of calcium from the skeletal reserves and milk fever results

the proportion of, say, 200 cc. in front and 400 cc. behind. The sites of injection are well massaged so as to partially disperse the fluid.

I would advise practitioners who intend to practice the calcium treatment to begin by confining themselves to the use of the ampoules containing an already prepared solution. This need only be warmed to approximately 105° F. and injected at once.

I believe that this method of treatment can be regarded as at least equal in its specific efficacy to that of mammary inflation over which it possesses certain advantages, in so far that it obviates interference with the udder, a very important organ in the dairy cow; it causes no interference with milk secretion such as may be occasioned by mammary inflation; it is a rational treatment based on scientific principles, and thus gives the practitioner a certain prestige which he did not possess in practicing the inexplicable treatment of mammary inflation.

The new treatment discourages the pernicious practice of home doctoring, mammary inflation being commonly practiced by laymen, often with dire results. Messrs. Sandoz has agreed that no person other than a member of the veterinary of medical professions will be supplied with calcium gluconate.

On the other hand, a number of complaints have been received that the injection of calcium gluconate is sometimes followed by swellings that persist for some days, and even result in abscess formation. So far, we have been unable to find a definite cause for this unfortunate complication.

In a private communication Mr. William Hepburn, M. R. C. V. S., Aberdeen, states that he has treated approximately 200 cases of milk fever with calcium gluconate alone. The results were uniformly successful and no untoward complications occurred with the exception of one case which developed an abscess at the site of injection. In this particular case the calcium was imperfectly dissolved.

It is curious that some practitioners have had no trouble, while with others it is the reverse.

It is, of course, necessary to ensure that the injection be made under aseptic conditions and practitioners, who follow a system such as that above indicated, now find that the injection can be made without the occurrence of untoward sequelae.

The practice of calcium injection in the *prevention* of milk fever is still in its experimental stage, but experiments indicate that, in those cows which are highly subject to attack, calcium gluconate in doses of about 200 cc. of the ampouled solution injected immediately after calving and repeated 20 hours later provides an effectual means of prevention.

Calcium injection and mammary inflation may be combined with marked benefit in severe and relapsing cases, but the comparative value of the two treatments can only be assessed by time and experience.

At least it may be said that the calcium treatment is rational in that it is based on scientific principles, and that its specific curative effects can be described as perhaps the most spectacular produced by a medicinal substance in any naturally occurring disease throughout the whole range of hominal or veterinary medicine.

In a previous paper[6] I have shown that the so-called "lambing sickness" of ewes also represents an acute hypocalcemia; indeed, I believe it is identical in its essential pathology with milk fever. In this disease the injection of calcium (Sandoz) has also proved of specific efficacy. I have had no opportunity of determining the blood-calcium concentration in so-called "eclampsia" of the parturient sow and bitch, but that these conditions are allied to milk fever of the cow may be assumed from the fact that in the several cases treated by calcium injection which have come within my notice, all have shown rapid and complete curative response.

I have records of a few cases of transit tetany in mares in which calcium injection has been applied; the recoveries in each case were rapid, but as a number of cases of

[6] Greig, J. R., *Vety. Rec.*, 1929, IX, 509.

transit tetany recover spontaneously, further data is required before definite conclusions can be drawn.

But it is in yet another diseased condition that calcium gluconate has been found of especial value, and it is to this condition that I would venture to direct the attention of American veterinarians.

In Scotland we meet with a disease clinically indistinguishable from parturient milk fever in cows at any stage of lactation. These cases are generally described as "delayed milk fever," or "atypical milk fever," but similar conditions also commonly occur in dry cows and in bullocks; these are often referred to by the generic term "grass staggers." The name is probably applied to a number of disease entities of similar clinical manifestation, but a considerable proportion of these cases respond to calcium injection as readily as do typical cases of parturient milk fever.

It may not be too much to hope that the discovery of the specific efficacy of calcium in milk fever has permitted us to enter a new field of cattle pathology.

TREATMENT OF ASEPTIC PODODERMATITIS ACUTA — LAMINITIS

It is unnecessary to discuss the etiology and pathology of this condition.

The classic treatments as described in Dollar's Surgery and others were at best, in many cases, very unsatisfactory. During the past few years the treatment with normal horse serum, injecting about 100cc of normal horse serum subcutaneously, has come into general use with very gratifying results.

The following report of cases, wherein a modification of this method was used, is given with the hope that further experimentation will result. The features which made this method preferable to the normal serum treatment are that the material is always at hand and that there is no cost to the practitioner for such material.

The treatment consists in the use of whole blood from another animal of like species, injecting it subcutaneously into the animal to be treated. This is done by inserting a long hypodermic needle of suitable size into the jugular vein of the donor and, by the use of a large hypodermic syringe, draw the syringe full of the blood, disengage the syringe and with another needle inject the blood into the recipient subcutaneously. Repeat this until sufficient blood had been given the patient, when the needle may be removed from the donor.

The only adjunct to this treatment was the giving of a purgative.

The first case treated in this manner was a mule which I had treated the evening previously for engorgement of the stomach. Upon being called to see the patient again the next morning I found it very lame, with a bounding digital pulse, rapid breathing and elevated temperature.

Having used the normal horse serum successfully in such cases, but not having the serum on hand, I reasoned that whole blood would have the desired effect if given in slightly larger doses. This mule, weighing about 1,000 pounds, was given 150cc of the whole blood of another mule in the lot, and by evening the symptoms had abated and the patient was apparently normal.

Another case was a mare found down with an aggravated case of laminitis. No symptoms of colic were present, but as this mare was down at a straw stack where oats had been thrashed the day previously it was presumed that she had eaten too much of the shattered grain.

This mare was given 120cc of whole blood from a mule that persisted in staying around the mare while we were making the examination, and a purgative bolus. The mare made a very nice recovery in about twelve hours.

Another case was a shetland pony which was taken out and ridden at the gallop over the paved streets. The next morning was showing the very painful symptoms of road founder. 80cc of whole blood from the mate was given with a purgative and the pony made an uneventful recovery.

The blood should be distribued in several places under the skin of the patient.

Temple, Texas.

T. O. Booth.

Infectious Abortion of Cattle, Swine and Sheep in the United States*

By W. E. COTTON, Bethesda, Maryland
Superintendent of Experiment Station, U. S. Department of Agriculture, Bureau of Animal Industry

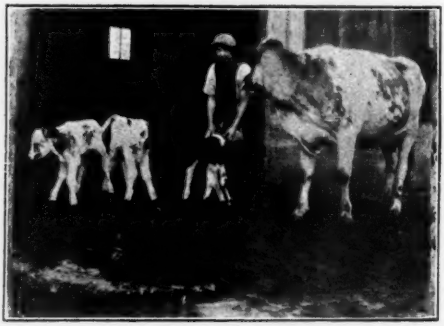
IT IS probable that the greatest cattle plague in the United States is infectious abortion. The disease in swine has appeared in the principal hog-raising states, but does not yet cause sufficient economic loss for alarm. However, it has attracted considerable attention of late because it has been found that infectious abortion of both swine and cattle is of significance for human health. Abortion in sheep has not been reported as causing severe loses except in a few localities.

Since infectious abortion of cattle (Bang's disease) far exceeds in importance that of other species of animals, the principal part of this report will be given over to its discussion. The disease appears to have reached about every part of the United States and infected a large proportion of herds in the older dairy and cattle-raising sections. No systematic survey to determine the incidence of the disease has ben made, but much blood-testing has been done in a number of States, which indicates that the proportion of infected herds in some localities may exceed 50 per cent and the number of reacting cattle in such herds may average about 20 per cent. The losses caused by the malady have been estimated to exceed $50,000,000.00 per annum and may be greatly in excess of this figure.

Unusual interest has been shown in the disease of late because of the realization that it is spreading and of its relation to undulant fever. The dairymen and cattle owners are now rapidly awakening to the serious condition which prevails, and to the need for attempting to prevent further spread of the disease, and if possible free their herds from it.

A number of States have laws or regulations either requiring that breeding or dairy cattle entering them be negative to the blood-test, or excluding those that have given positive or suspicious reaction to the test. Other States have regulations looking to the control of the disease within their borders, or are encouraging and helping stock owners to establish and maintain abortion-free accredited herds. It is probable that some of the State regulations instituted are premature and will be found difficult to enforce owing to imperfect means of detecting infected animals, but a beginning has been made toward controlling the disease, and time will, no doubt, point out the imperfections of present regulations and lead to their correction.

Efforts to free herds from the malady by the elimination or segregation of reactors appears to be meeting with success; but, of course, it is realized that this method of control is not applicable under all conditions. There are herds in which the percentage of infection is so high and the facilities for segregation so poor that some other means must be adopted. Modifications of the segregation and elimination method have



Bull Triplets, delivered by Dr. R. L. Brown, Janesville, Wis.

* Presented at the 11th International Veterinary Congress, London, England, August 3-8, 1930.

been tried. The raising of a clean herd from an infected one by protecting the offspring from infection after weaning, limiting the amount of infection and its spread by the use of maternity stalls and special herd management, and the use of bacterins and vaccines—all of these have been, or are being, tried in widely separated places throughout the country.

Diagnosis

Active investigations of infectious abortion are in progress, both by the Federal Bureau of Animal Industry and several State Universities and Experiment Stations, working independently and in co-operation. Many phases of the problem are being attacked. One of first importance to receive attention is methods of diagnosis. Since the last International Congress, 16 years ago, considerable advance has been made in methods of diagnosis. No strikingly new test has been brought out, but much has been done to determine the relative value of the several tests that had been suggested, and in improving the technique and interpretation of the best of them. The use of abortin has been disappointing; even the double intradermic test of Holtum[1], which appeared to give good results in his hands, has not been found by other investigators to be satisfactory. Our experience with it has been far from encouraging, as it failed to give reaction in some of the animals known to be infected and gave marked reaction in some animals certainly known to be free from infection. The use of the complicated complement-fixation test has been practically abandoned for routine work by most investigators for the simpler and equally reliable agglutination test, which in some form is the test commonly used in America today. The rapid agglutination test of Huddleson[2] is being used by a number of investigators, apparently with good results. Our experience with it indicates that it checks reasonably well with the tube test. The rapid test has the advantage that it can be quickly and easily made with simple apparatus. Should the serological testing of cattle become general, this test promises to be a very useful one, if after repeated trials it is found to be sufficiently accurate and reliable. However, at present most investigators seem to prefer the tube method.

Compared to the use of tuberculin for the diagnosis of tuberculosis, the best of our methods for the detection of infectious abortion, the agglutination test, is far from perfect. The information obtained is not nearly so exact, and contrary to what happens in the case of tuberculosis, animals may become spreaders of infection before they react. Furthermore, it is more difficult to interpret reactions. A tuberculin reaction indicates that the animal giving it is infected, whereas an abortion reaction indicates that the animal either is now, or has been but no longer is, infected. These shortcomings make the use of the test for control and eradication purposes somewhat complicated and sometimes render the elimination of all infected animals difficult and somewhat wasteful. Undoubtedly both the technique for making the test and its interpretation can be improved. The Bureau's work indicates that by proper interpretation differentiation between present and past infection within reasonable limits of error is possible. Several years ago it was found that of a number of cows whose blood-sera reacted to a titre of 1 to 200 or above, as the test is made by the Bureau, more than 80 per cent. eliminated *Bacterium abortus* with their milk, whereas cows whose sera reacted to a titre of 1 to 100 or less, provided they were not recently infected and their sera just beginning to react, rarely did. More recent experiments have confirmed the earlier work and have shown that of cows whose blood-sera reacted to a titre of 1 to 1,000 or more, practically all had infected udders. If, then, the agglutination test is standardized it should be possible by it alone to differentiate with a reasonable degree of accuracy reacting animals that are safe, and even possibly have considerable resistance, from those that carry the infection. To be able to do this

[1] HOLTUM, A. W. "A double intradermal test for the diagnosis of bovine contagious abortion," *Journ. of Comp. Path. and Ther.*, lxi, (1), pp. 25-53; (2) pp. 79-93.

[2] HUDDLESON, I. F., and ABELL, E. "Rapid macroscopic agglutination for the serum diagnosis of Bang's abortion disease," *Journ. Inf. Dis.*, vol. xlii, No. 3, p. 242.

with assurance would greatly increase the value of the test.

There has been some discrepancy in results obtained by different laboratories in making agglutination tests for abortion. These are, no doubt, largely due to difference in the density and character of the antigens used. It is not surprising that an organism so plastic as the abortion organism should exhibit a wide difference in its sensitiveness to agglutinins. It seems probable that, if standards are established for selecting and growing cultures as well as preparing and storing antigen, many of the differences in the results of different workers will disappear. That this will occur is indicated by the experience of the Bureau of Animal Industry, which has tested many thousands of blood samples in connection with its experiments on infectious abortion, and in efforts to free herds from the malady. Repeated tests of large numbers of animals, at intervals varying in length from a week to six months or more, and in numerous cases extending over a period of several years, have given consistent results. Animals have not suddenly lost or regained reactions, and whenever bacteriological findings could be compared with serum reactions they were found to be in harmony. Each batch of antigen used has been tested when made, and at intervals while stored, against known positive and negative sera from animals kept for this purpose, and any antigen not conforming to a standard is discarded.

A rather serious shortcoming of the agglutination test is the tardiness with which reactions sometimes appear following infection. Our experience leads to the belief that the reaction usually makes its appearance within three or four weeks, but sometimes it may be delayed for from three to four months, and, in occasional instances, may not appear until after the termination of pregnancy either by abortion or parturition. Here again the test for abortion falls short of the tuberculin test for tuberculosis in that it does not always determine the presence of infection until after the animal becomes a disseminator, whereas tuberculous animals practically all react to tuberculin before they are able to spread the disease. Several investigators have reported occasional animals that carried *B. abortus* in their udders without reacting, but that such cases are probably rare is indicated by the Bureau's failure, in the many tests it has made, to find one such animal.

Methods of Control and Eradication

Notwithstanding the shortcomings of the agglutination test, its use has been proved to eradicate the disease from herds through the elimination or segregation of reactors. Tests and removal of reactors at two-month intervals have proved effective in many herds, but in others the free unit dwindles to rather small proportion before the progress of the disease is arrested. What to do with the reactors often becomes a serious problem. Many of them are good producers and continue to give birth to vigorous calves year after year, although their milk remains infected. Others reacting in low titre apparently do not harbour infection, yet our knowledge is so incomplete that authorities are not agreed as to the final outcome of such animals, and few persons have the fortitude to advise returning them to the free unit. In herds in which only a few reactors are found it is probably best to sell them for immediate slaughter or to go into a herd of like animals. If the number of reactors is too great or too valuable to be disposed of, the two-herd method is advised where this can be economically provided for. This method requires separate pastures, pens, and stables, with separate stable utensils, besides constant vigilance to keep infection from creeping from the infected to the clean herd. In some herds success has been attained, even though the free and infected units were separated by relatively short distances, but in others infection spreads from the infected to the free unit, even though the conditions for preventing it seem to be good. There is evidently great variation in the ability of *B. abortus* to infect and in the susceptibility of cattle under certain conditions which we do not yet understand. If it were possible to make an equitable exchange of animals, a promising method would seem to be to sell all reactors to persons keeping herds

made up of infected animals. Use of such animals could then be made as long as they were profitable for the production of milk and calves. The milk could be pasteurized, and the calves, with proper handling, could be used to build up a clean herd. This would make it possible to salvage reacting animals with the least danger of their passing the disease on to others.

While the methods based on segregation or elimination of reactors are more desirable, where they can be used, than less drastic measures, they cannot be economically used on a large number of farms because of lack of facilities for maintaining separate herds, or because too large a proportion of animals are already infected. In such herds the use of maternity stalls and other simple measures to reduce the chances of infection will accomplish much in controlling the disease and finally eradicating it.

There is a class of herds in which the methods described seem to be impracticable, namely, when the disease has become so well established or is spreading so rapidly that checking it by sanitation and special herd management appears to be impossible, and there seems nothing to be done but stand aside and let nature take her course, or else adopt some means of artificial immunization.

Vaccination

This brings us to the subject of vaccination, one on which there is a great difference of opinion, notwithstanding that it has been about a quarter of a century since the investigation of Doctor Bang[3] suggested that this method of handling the disease might hold promise and the work of McFadyean and Stockman[4] seemed also to indicate that vaccination might greatly assist in controlling the malady. Since then other investigators have given attention to the subject, and vaccine has been placed on the market and used throughout the country by the profession for a number of years. Reports of the efficacy of the commercial abortion vaccine, however, seem to be very conflicting and on the whole discouraging. Many investigators and live stock sanitary officials hold that its use is dangerous and objectionable.

Examinations, made by the Bureau of Animal Industry at different times, of commercial abortion vaccines have shown a very great lack of uniformity in them. Some were dead, some nearly so, some avirulent for guinea-pigs, others slightly so, and still others fully virulent for these animals. One was even found to contain a porcine strain, although intended for use on cattle. With such a great variation in the quality of vaccines, it is not surprising that results should be so widely different.

Carefully controlled and repeated experiments have shown that abortion vaccine, freshly prepared from virulent *B. abortus*, and injected subcutaneously about two months before conception markedly increases resistance, but does not afford complete protection. However, it sometimes becomes localized in the udder, especially when recently isolated cultures are used in its preparation.

The use of abortion vaccine of sufficient virulence to be capable of causing infectious abortion in pregnant animals or to bring about udder infection is in general quite objectionable; especially is this true now that it seems practically certain that abortion-infected milk has been responsible for some of the reported cases of undulant fever. To be sure, many udders will become infected if no vaccine is used and abortion disease is allowed to take its course, but there is usually a stronger feeling against a danger artificially produced than against one that occurs naturally, and there is also a fear that the organism used in the vaccine may have some more objectionable quality than those naturally occurring in milk. Hart and Traum[5] of California reported that of 16 head of non-pregnant milking cows vaccinated with a mixture of four strains of *B. abortus*, two of which were old laboratory strains and the others isolated one and two years previously, ten gave off *B. abortus* in their milk. One began to do so in a week and the

[3] Bang, Bernard. "Infectious abortion in cattle," *Journ. of Comp. Path. and Ther.*, vol. xix, No. 3, 1906.

[4] McFadyean, J., and Stockman, S. "Epizootic abortion in cattle," Report of the Departmental Committee appointed by the Board of Agriculture and Fisheries to inquire into epizootic abortion, London, 1909.

[5] Hart, G. H., and Traum, J. "Technical Paper No. 19," *Univ. of Calif. Agric. Exp. Sta.*, 1925.

other 9 in from 13 to 55 days. The experiment indicated that this infection would probably continue to the end of the lactation periods in which the cows were vaccinated, but data as to whether the udders became permanently infected were not available when the report was published. This experiment indicates that cows recently vaccinated during lactation are unsafe animals to add to a non-infected herd, and that there is danger of *B. abortus* in the vaccine being conveyed to man through the use of milk from such cows.

Avirulent Vaccine

The Michigan Agricultural Experiment Station[6] has for several years been conducting experiments in the use of an avirulent strain of *B. abortus* with apparently encouraging results. The Bureau of Animal Industry Experiment Station[7] has also carried on experiments with another avirulent strain, using it on both pregnant and non-pregnant animals. The results of the first series of expermients indicate that while this particular strain of *B. abortus* afforded some protection when administered to pregnant cows and heifers, it has little or no value when given three months before conception. An experiment in connection with the use of a vaccine prepared from a porcine strain of *B. abortus* proved it to be more effective as a protective treatment for pregnant animals than the attenuated bovine strain, in fact, protecting all of a limited number of animals treated with it, but when used three months before conception it had, like the avirulent bovine strain, no measurable value. Unfortunately the porcine vaccine invaded the udders of some of the animals and caused them to become carriers and eliminators of a type of germ that is believed to be more pathogenic for man than the bovine type. This, therefore, destroys all hope of using the porcine organism in the preparation of vaccine for cattle. It also teaches us that great care should be exercised in the selection of strains of *B. abortus* for vaccine.

[6] HUDDLESON, I. F. "Vaccinal immunization of animals against abortus (Bang) infection," *Proc.* Twenty-ninth Ann. Meet. of U. S. Livestock San. Assoc., 1925, p. 210.

[7] "Report of Chief of Bureau of Animal Industry," U. S. Dept. of Agric., 1928, p. 21.

In contrast to the results obtained with the avirulent bovine and virulent porcine strains on non-pregnant animals, several such animals, given vaccine made from a recently isolated bovine strain, produced apparently normal calves, although receiving the same exposure as the animals vaccinated with the porcine and attenuated bovine strains. It is likely that our avirulent vaccine had become too weak and that a somewhat stronger one would have been more effective and yet not have caused udder infection. Investigations now in progress with strains of three different degrees of virulence indicate that there may be a certain degree of virulence that will afford protection without infecting the udder or causing infection even in pregnant animals, but if the virulence is below this it does not afford sufficient protection and if above it endangers the udder. Should this prove to be the case, then the problem presented for solution will be, since nothing in biology is stable, how long will our strain of proper virulence remain so, and how can we measure its virulence to determine when it has become no longer potent. At present the guinea-pig seems to be the only practical means of measuring virulence.

Calfhood Vaccination

In addition to trying to determine the actual value of abortion vaccine, and if possible improving it, the Bureau has given some attention to devising better methods of using it. Instead of vaccinating shortly before service, Dr. J. M. Buck, Assistant Superintendent of the Bureau's Experiment Station, has tried vaccination during calfhood with encouraging results. The advantages in vaccinating at this time are that there would probably be less danger of infecting udders than in the case of older animals, and should some of the calves become infected through vaccination, they could be detected by means of the blood-test and eliminated long before they became spreaders of infection, because reactions caused by vaccination soon subside, provided the animals do not become carriers. It should be realized that calfhood vaccination has not

passed the experimental stage, but it seems to offer promise.

While it is not believed that vaccination will take the place of the much better methods of elimination, segregation, and sanitation, it would seem to have a limited place in reducing losses in herds where other means of control are impracticable. The vaccine used should be of as low virulence as is compatible with producing sufficient immunity to resist ordinary exposure, and there should be rigid supervision over its production, distribution and use, for it contains the possibilities for evil as well as good.

Newly Recognized Routes of Infection

The earlier idea that the usual route of infection was directly through the genital tract, either at the time of service or through soiling of the external genitals, gave way to the belief that ingestion is the principal route and that the bull is not of great importance, at least directly through service, in transmitting the disease. This is the generally accepted belief today. However, while it has been definitely proved that cows and heifers can readily be infected by way of the digestive tract and that it is difficult to infect by the bull, there are reasons to believe that there may be other routes of considerable importance.

Several years ago the late Dr. E. C. Schroeder[8] and the writer proved that guinea-pigs could be infected readily by dropping a single drop of a suspension of *B. abortus* into the eye, whereas an equal or greater amount failed to infect by way of the digestive tract. Later we successfully infected two cows by dropping into the eye of one a single drop of a dense suspension of *B. abortus* and into the other two drops of stomach fluid from an aborted fetus. Since then other cows and heifers have been infected by the same method, and it is now being regularly used by the Bureau's Experiment Station to give exposure to cattle in vaccination and other experiments, as it has been found to be much more certain than through the digestive tract. Whether or not this route is of importance in nature we are unable to say, but there would seem to be ample opportunity for infected *B. abortus* material discharged by infected cows to be splashed into the eyes of other cows feeding from the ground in barnyards or pastures.

Another possible route to which we are giving some attention is the skin. Hardy, Hudson and Jordon[9] report infecting guinea-pigs with *B. abortus* through the unbroken skin, and suggest the possibility of this route for other animals. We have succeeded in infecting two pregnant heifers by shaving small areas of skin and scraping it until serum oozed out, then applying a suspension of a recently isolated *B. abortus* culture. In these cases agglutination reactions began to appear within 24 days. Both animals gave birth to premature calves, and the afterbirths gave evidences of being infected.

Efforts are now being made to infect two pregnant heifers through the unbroken skin, suspensions of *B. abortus* being applied to the skin and the animals secured in such manner that the infection would not reach other possible portals of entry. Both animals began to react within 16 days, and it is believed that they have become infected.

It is quite possible that slight abrasions in the skin or possibly the unbroken skin may be portals of invasion of considerable importance, possibly even greater than the digestive tract.

The Significance of the Swine Type of B. Abortus for Cattle

The belief that *B. abortus* in milk may cause undulant fever and the probability that the porcine type of the organism is more virulent than the bovine for man, raises the question as to whether the former as well as the latter may not invade the udders of cows. Investigations made by the Bureau several years ago indicated that the porcine type had little significance for cattle and the bovine type little for swine. At least repeated attempts to infect cattle with the por-

[8] Schroeder, E. C., and Cotton, W. E. "Infection of guinea-pigs *via* conjunctival mucosa with bacillus of infectious abortion," *Journ. Amer. Vet. Med. Assoc.*, vol. xviii, New Series, No. 2, 1924.

[9] Hardy, A. V., Hudson, M. G., and Jordan, C. F. "The skin as a portal of entry in *B. melitensis* infections," *Journ. Inf. Dis.*, vol. xlv, No. 4, 1929, pp. 271-282.

cine type or swine with the cattle type, by natural exposure, failed. However, within the last few years the porcine type has been occasionally reported to have been isolated from the udders of cows. In seeking an explanation for this type of infection appearing in the udder, further efforts have been made to infect cows with the porcine organism, and it was found that it could be done through the conjunctiva. Whether this occurs naturally or whether the reported cases of udder infection with the porcine organism are traceable to use of vaccine containing this type of micro-organism is uncertain. It has been proved that if vaccine of this kind is injected subcutaneously into cattle it may infect the udder and, moreover, in an examination of the vaccines on the market that were supposed to be bovine, one was found to be of the porcine type as has already been stated. While the relation between swine abortion and that of cattle has not been definitely worked out, the indications are that the two are probably not inter-communicable to any great extent by natural means, though they are through inoculation.

Infectious Abortion of Swine

So far as swine abortion itself is concerned the investigations of several state experiment stations and those of the Bureau have shown that in a general way the disease in swine behaves much as it does in cattle. The organism localizes in the udder and infection may occur through feeding. Boars seem to acquire the disease more often than bulls, and probably play a greater role in transmitting the disease. Experience leads us to believe that sows, through the retention of fetal membranes and the chronic metritis set up in consequence, may retain massive infection in their uteri for long periods. Furthermore, we have found that the ovary may become infected, a condition that we have not found in cattle. In one case of severe metritis involving the deeper structures of the uterus, probably resulting from an unobserved abortion, several necrotic areas were found in the kidney fat. These were probably, in part, due to kidney worms, many of which were present in other portions of the kidney fat. *B. abortus* was found to be present in these necrotic areas.

Infectious abortion of swine does not appear to be of nearly the economic importance that bovine abortion is. This may be in part due to seasonal breeding, sows all farrowing about the same time. An abortion among them would usually infect other animals too late in their short period of gestation to cause the loss of offspring. The control of abortion in swine is probably a less difficult problem than that of cattle because of the short period of gestation and since replacements of breeding animals can be made so readily.

It has been shown that the porcine type of *B. abortus* has certain characteristics not possessed by the bovine type, as follows: It grows vigorously when first isolated from aborting sows under normal atmospheric conditions, whereas the bovine type requires a reduced oxygen tension. The effect of certain aniline dyes on its growth is different, as shown by Huddleson[10], and its power to utilize sugars is unlike the bovine type, as shown by McAlpine and Slanetz[11]. The lesions produced in guinea-pigs by it are often markedly different than those caused by the bovine type. They show a marked tendency to necrosis and to affect

[10] HUDDLESON, I. F. "Differentiation of species of genus Brucella," undulant fever symposium, *Amer. Pub. Health Assoc.*, 1929.

[11] MCALPINE, JAMES G., and SLANETZ, CHARLES A. "Studies on the metabolism of the abortus melitensis group," *Journ. Inf. Dis.*, vol. xlii, No. 1, 1928, pp. 73-78.

California Triplets

the bones, and may appear in unusual locations, such as the orbits. The disease caused in guinea-pigs by the porcine type is more severe and recovery is less frequent. Some of these animals injected with this type of *B. abortus* at the Bureau's Experiment Station and killed more than two years later, exhibited very marked lesions in lungs, liver, spleen, lymph-glands, and epididymides. The lesions appeared to be active, and subcutaneous inoculations made from them into other guinea-pigs produced very marked lesions. Guinea-pigs inoculated with bovine strains usually show only retrogressive lesions after a year.

Bacterium Abortus Infection of Man

The occurrence of undulant fever in man, traceable to *B. abortus,* has been given much publicity during the last few years. A list of reported cases has been slowly growing, reaching 669 in 1928[12] and more than 800 in 1929[13]. Evidence to prove that many of the reported cases of undulant fever have been caused by the consumption of infected cows' milk is so strong, even though circumstantial, that it is useless to cling longer to the hope or belief that milk is innocent. To be sure, the magnitude of the danger from milk is not known. It seems at present to be small, almost insignificant, when compared with many other dangers with which we are surrounded.

Human *B. abortus* infection, according to some investigators, occurs more frequently in rural districts, and in these there is a much larger proportion of men that become infected than women. This indicates that contact with infected animals is responsible for a large share of the cases on farms. Other investigators who have collected and studied cases in and around cities have found the cases to be about equally divided between men and women, as would be expected if milk was the source of infection. A number of cases have been found among packing-house employes, especially those who handled the viscera of hogs.

The great disparity between the cases of undulant fever and the frequency of exposure through infected milk is difficult to explain. Several million people in the United States have probably been using raw milk from infected cows for many years and still are doing so, and yet the number of cases of undulant fever caused by *B. abortus* reported last year, including those due to contact, was only somewhat in excess of 800. Of course there are, no doubt, many cases not reported, but even if there were several times as many as reported the proportion of infections to the number of people exposed through drinking milk would be very small. It seems probable that man is, in general, highly resistant to the disease, and that there are relatively only a very few individuals who are susceptible, or that something more than the ordinary type of bovine abortion is required to infect, or else that a very large number of this type is necessary. *B. abortus* varies in virulence, and the number eliminated from the udders of cows is very far from being constant. While the strains of bovine *B. abortus* usually found in milk may have a very low pathogenicity for man, it is possible that some aberrant strain much more virulent for him may sometimes be found in it. Unusual types of the micro-organism have actually been isolated from the udders of cows in several instances. Huddleson[10] examined 96 strains from cows and found 86 belonged to the bovine, 8 to the porcine and 2 to the melitensis type. These came from all parts of the United States, southern Europe and Rhodesia. There, therefore, appears to be a possibility of the porcine type of the organism in some way invading udders of cows, even though the cattle may be relatively insusceptible to this type through natural exposure. The recovery of two strains of melitensis from cows indicates that there is also danger of this organism infecting them, a somewhat serious possibility should it often occur.

It is far too early to predict the significance of *B. abortus* to human health. We are confronted with a newly-found danger which we as yet poorly understand. We have reason to hope that it is not a serious one, but we do not know. Fortunately pas-

[12] *Supplement No. 72 to U. S. Public Health Report,* 1928, pp. 64-65.
[13] Preliminary unpublished statement, U. S. Public Health Service.

teurization will remove whatever danger there may be from milk, but unfortunately, in America, perhaps about half the population consume milk raw. While milk consumed in the large cities is for the most part pasteurized, that of the small towns and rural sections seldom is, and it seems doubtful whether it will be for some time to come, though the knowledge that raw milk may contain a germ which sometimes causes undulant fever will, no doubt, stimulate increased efforts to bring about universal pasteurization.

Abortion of Sheep

We have yet to deal with infectious abortion of sheep, which is due to a vibrio. In America this is not a nation-wide problem as is Bang's abortion disease of cattle. Infectious abortion of sheep has been troublesome in only a few sections. The Montana Experiment Station and Livestock Sanitary Board[14] have given some attention to its investigation. The studies have indicated that the disease may be controlled by preventing the animals from drinking stagnant water infected with the micro-organisms.

Conclusions and Recommendations

The following conclusions and recommendations seem to be justified:—

1. Greatly increased interest in infectious abortion has been stimulated in the United States by the spread of the malady to nearly every section of the country and the discovery that the disease has a significance for human health.

2. Means of diagnosis are worthy of intensive study, and this is recommended. While the agglutination test, the most satisfactory one now in use, is reasonably accurate, it has not been sufficiently standardized, nor does it give information enough to be entirely satisfactory for regulatory work.

3. While the disease may be economically eradicated from many herds by the elimination or segregation of reactors, it is doubtful whether these methods are practicable in the majority. In these, less drastic but slower methods promise to be successful. It is recommended that the several methods of control receive exhaustive field trials under widely different conditions to determine their practicability.

4. Vaccine probably has a limited place in abortion control, but its production, distribution, and use should be under rigid supervision. There is a possibility that a fairly effective avirulent vaccine may be developed which is free from the objectionable features that attend the virulent.

5. It has been shown that cattle may be infected by the way of the conjunctiva and also probably through the unbroken skin. Further studies to determine the comparative importance of these routes and that of the digestive tract in both cattle and hogs are highly desirable and are recommended.

6. The relation of swine abortion to that of the bovine species should be more definitely determined, particularly in connection with the ability of the causal agent of the former to invade and to maintain itself in the udders of cows.

7. The question of human infection with *B. abortus* is of great importance because so many people are being exposed daily, both by contact with infected animals and through the consumption of milk containing this micro-organism. The sources of human infection and the possibility that the *Brucella melitensis* may invade the udders of cows and thus become a greater menace to human health deserve study.

[14] WELCH, HOWARD and MARSH, HADLEIGH. "Infectious abortion in sheep," *Bulletin* 181 *Montana Exp. Sta. and Mont. Livestock Sanitary Board.*

MEAT INSPECTION COVERS LARGE FIELD

Federal meat inspection was carried on at 804 establishments in 259 cities and towns. This work included the inspection of approximately 75 million animals, both before and at the time of slaughter, and the inspection of the resulting meat food products through different stages of preparation. Inspections were also made of 68,000 tons of various fresh, canned, and cured meats and meat food products imported from foreign countries.

A Survey of Icterohematuria in Sheep in Colorado

By FLOYD CROSS and I. E. NEWSOM, Ft. Collins, Colorado
Contribution from the Section of Veterinary Pathology,
Colorado Agricultural Experiment Station

RECENT reports of icterohematuria in New York[1] and Nevada[2] where the disease has never before been described, have again called attention to this peculiar malady. The authors are therefore offering for publication a survey made in the summer of 1929. The survey deals only with the mountainous region of the state as it has become apparent that the disease originates there. Since our previous publication[3] we have had opportunity to study seven outbreaks of the disease occurring in the plains area, but in every case these animals had recently been shipped from the mountainous region.

Nothing in our observations has tended to change the classical description of the malady nor our previously expressed views that the cause is still unknown. Repeated inoculations of blood and even spleen pulp have failed to transmit the disease. No sheep under one year of age have been seen affected. These observations seem to clearly separate the condition from that described by Motas in Rumania as being due to Piroplasma ovis and being transmitted by Rhipicephalus bursa.

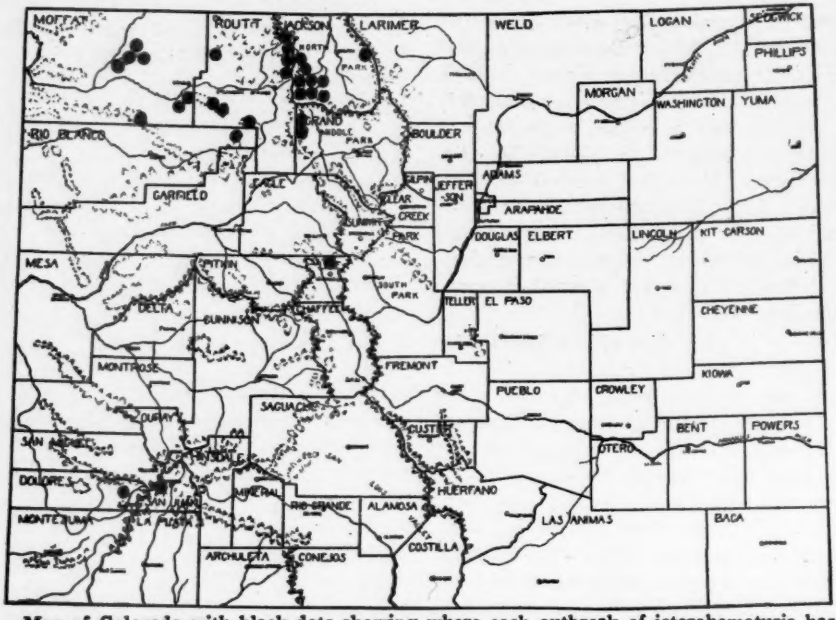
The fact that the disease is confined to the mountainous region indicates that it may be tick-borne. Dermacentor venustus is common on sheep in these regions during May and June but there is no further evidence to show that it is in reality concerned with the transmission of the disease. It is not surprising that the disease has appeared in Nevada since it has previously been known to exist in Montana, Wyoming and Utah but no explanation seems available for its presence in New York.

The disease seems to be most prevalent in the northwestern corner of the state, being for the most part confined to the three counties of Jackson, Routt and Moffat. The history of nine bands of sheep in which the disease has been observed was collected in Jackson County. In only one instance has it been reported in sheep ranged on the eastern boundary of the county, all other outbreaks having been found in sheep summered on the Rabbit Ear Range which forms the western boundary. In Routt County data were collected from eight bands in which the disease had appeared. It is rather widely distributed throughout the entire county. In Moffat County information was obtained on seven bands in which the disease had been noted. It seems to be found only in the central and eastern portions of this county. It was found in one band ranged in Rio Blanco County, just across the boundary from Routt County. In Grand County only two sheepmen out of many interviewed had even observed the disease in their flocks. Our records show three outbreaks of icterohematuria in sheep received on the eastern slope from districts other than those mentioned, one shipment originating in Lake County, one from San Juan and one from Dolores County. Numerous sheepmen interviewed in these three districts had no knowledge of such a disease ever having been in their sheep. All other portions of the state so far as could be learned are entirely free from the disease.

The information collected indicates that the malady appears for the most part in sheep that have recently been introduced into the territories mentioned. After having

[1] Olafson, P. Icterohematuria in Sheep. *Cornell Veterinarian.* Vol. 20, p. 232.
[2] Personal Communication from Doctor Robert Dill, State Board of Sheep Commissioners.
[3] Newsom, I. E., and Cross, Floyd. Icterohematuria in Sheep. *North American Veterinarian.* Vol. 2, p. 205. 1921.

been summered in these regions for the first time the outbreak appears during the following fall and winter. When the same sheep are run the second summer on the same range there may be no loss at all or at least the percentage affected is greatly reduced. However, the loss may continue for three or more seasons but as a rule it gradually decreases until only an occasional animal is affected. Sheepmen have taken advantage of this fact and are adding to their flocks only by the purchase of native raised sheep or are saving their ewe lambs to use for breeding purposes. Sheep are being brought into these districts from elsewhere in smaller numbers than formerly as the introduction of outside animals involves considerable risk.



Map of Colorado with black dots showing where each outbreak of icterohematuria has originated.

The following figures serve to illustrate the points mentioned above. The history of 23 flocks in which the disease has been known to exist was obtained. Eleven of these representing 12,140 sheep had the disease for one season only with a death loss of 4.7%. Five flocks with a total of 12,700 sheep showed the disease for two consecutive seasons, the first season with a loss of 1.8% and the second with a loss of 0.88%. Five flocks of 22,500 sheep in three seasons gave a death loss of 2.02% the first, 1.01% the second, and 0.43% the third. Two flocks have sustained a loss for more than three seasons.

One lot of 10,000 sheep for the five seasons from 1923 to 1927 showed a loss in 1923 of 1.07% followed by a gradual decrease until in 1927 the loss was only 0.01% with no loss whatever in 1928. The other, a flock of 2,400, has had a loss for the last four seasons. Four years ago the loss was 8.33% and last year it was 1.05%.

Placing a value of $10.00 per head on each sheep lost, it is estimated this disease cost the sheepmen of Colorado as follows:

1920	$2,000.00
1921	no losses reported
1922	no losses reported
1923	1,750.00
1924	2,630.00
1925	1,770.00

1926 ..... 5,970.00
1927 ..... 6,140.00
1928 ..... 1,300.00

The high figures for the years 1926 and 1927 can perhaps be explained by the fact that during these years many ranchers in these districts were starting sheep raising for the first time, hence many sheep were brought in from other districts.

This survey would seem to indicate that the disease, icterohematuria, is limited for

Sheep with Icterohematuria

the most part to the three northwestern counties of Colorado. It was first reported from these districts in 1920 and has made its appearance almost yearly since that time. The greatest losses were sustained in 1927, which can perhaps be explained by the fact that many new sheep were introduced at about that time. Sheep seem to be most susceptible to the disease when run on the ranges in these districts for the first time and gradually develop considerable resistance to the disease when repeated on the same range for two or more seasons. Lambs raised on these ranges appear also to have developed considerable resistance. The disease does not appear to be on the increase at present.

At Jamesburg, in Vermilion County, a single mad dog bit at least 19 different people, all of whom were given anti-rabic treatment. Another rabid dog at Spring Valley bit nine different people.—*Illinois Health Bulletin.*

ADULTERATED AND MISBRANDED DRUGS

A fine of $500.00 and costs was recently imposed upon the P. J. Noyes Company of Lancaster, N. H., for interstate shipping of adulterated and misbranded drugs, including calomel tablets, tincture of nux vomica, strychnine sulphate tablets and other products. The action was brought by the Federal Food and Drug Administration and the Company pleaded guilty to the charges. This is the second time this Company has been fined for violation of the Food and Drug Act.

Since the Food and Drug Act went into effect in 1907, the government has instituted 17,000 seizures and prosecutions for violation of the law.

ARTHRITIS IN A COW

I was called to see a ten-year-old Jersey cow weighing 850 pounds. She was very lame in left hind leg. I examined her very carefully and could find nothing to cause the lameness in the foot nor could I locate any place on her leg that showed any swelling or soreness. I told the owner that she might have twisted her leg in the lot, and that she would soon get over it.

As she was a good cow, I dropped by again to see her and found her no better. On examining her lame leg this second time I noticed that her left rear fetlock showed signs of being very sore to the touch. I prescribed 60 gr. asperin twice a day for three days, then skip three days and repeat until well.

The owner told me that after he had given this cow three doses of the asperin she walked with more ease and within two weeks from the time he started giving the medicine, she was practically well. I saw this cow the other day and she shows no signs of lameness.

I called it rheumatism. This little cow did not fall off on her milk flow very much during her lameness or during the treatment.

Cushing, Oklahoma. H. C. Groff.

The Physiology of Egg Production*

By E. A. HEWITT, Ames, Iowa
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The parts of a newly laid hen's egg are the shell, shell membranes, albumin, and yolk. In an egg that has been undisturbed for a short time the yolk floats in the albumin with a whitish disk, the blastoderm, about four millimeters in diameter, on its upper surface. If the yolk be rotated, it will return to its form position in a few minutes owing to its slightly lower specific gravity than that of the hemisphere containing the blastoderm. The blastoderm is the living part of the egg, from which the embryo and all its membranes are derived. In a fertilized egg the blastoderm is already in a fairly advanced stage of development when the egg is laid. This disk of blastoderm has three well defined areas, an outer whitish rim, within which is a clear zone, and in the center of this zone a somewhat elongated structure which is the embryo itself. The function of these three parts, constituting the blastoderm, is reproduction. All the rest of the egg is directly utilized for nutrition and protection. The yolk and blastoderm are enclosed within a delicate transparent membrane, the vitelline membrane, which holds the fluid yolk mass together. The yolk is formed in the ovary, the remainder of the egg is formed in the oviduct.

Fertilization of the egg takes place in the canterior portion of the oviduct, befor the albumin has been formed around the yolk. The spermatozoa traverse the entire length of the oviduct and are found in the uppermost portion in a fertile hen, one spermatozoon is all that is required, in fact, only one can be used in this union.

The period of life of the spermatozoa within the oviduct is considerable, as proved by the fact that hens may continue to lay fertile eggs for a period of at least three weeks after isolation from the cock. After the end of the third week the vitality of the spermatozoa is apparently reduced, as eggs laid during the fourth and fifth weeks may exhibit, at the most, abnormal cleavage, which soon ceases. Eggs laid forty days after isolation from the cock are certainly unfertilized, and do not develop. The so-called parthenogenetic cleavage or asexual cleavage is merely a phenomenon of fragmentation of the protoplasm; there is no true cell division.

The yolk or ovum may be called the most important part of the egg, since it contains within its outer wall or vitelline membrane, the germ or embryo and also the nourishment of the growing embryo. The yolk is nearly round and light yellow in color, the degree or intensity of the color varying with the character of the food. The yolk is composed of two distinct portions arranged in concentric rings or layers, one being light in color, and the other being darker yellow in color and more easily coagulable at a high temperature. In the lighter portion of the yolk is a hollow or indentation in the upper part of which and next the vitelline membrane, lies the germ, which can easily be distinguished by its whitish color and circular shape. The function of the yolk is to nourish the chick for the first few hours after hatching and during the early stages of its growth. It is just as essential to the young chick as is the colostrum to the calf. It supplies nutrients in easily digestible form, at the same time exerting a laxative influence, which starts the digestive processes.

In the developing embryo and young chick the yolk becomes incorporated in the yolk sac. In the course of expansion

* This is the second of a series of three articles by Doctor Hewitt on "The Physiology of Egg Production." The first article of this series appeared in the January, 1931, issue of VETERINARY MEDICINE. The third will appear in an early issue.

of the blastoderm and extension of the extra-embryonic body cavity over the surface of the yolk, it finally becomes enclosed in a separate sac. It remains connected by the yolk stalk with the intestine until finally some time after hatching it is absorbed completely. The yolk is absorbed by the entodermal lining of the yolk sac and is carried to the embryo in solution by means of the vitelline veins.

In composition the yolk is very rich in a phosphoprotein known as vitelline. Phosphoproteins resemble globulins but differ in that they yield phosphorus upon hydrolysis. The importance of phosphoproteins lies in the fact that they are the chief nutritive proteins for the growing young of birds and mammals.

The processes concerned in the formation of the yolk may be summarized as follows: Certain ones of the small oöcytes in the ovary are all the time coming into a state of physiological activity, while the hen is in a laying cycle. These oöcytes grow in size by the deposition of yolk until finally they are of the full size for laying. According to Gerhartz[5], the time required for this final growth of yolks preparatory to laying is not far from 20 days on the average.

The fully formed yolk, or ovum, leaves the follicle of the ovary through a rupture of the follicle along the stigma. This process is called ovulation. As it leaves the ovary the ovum is received by the funnel of the oviduct.

According to Pearl and Curtis[6] the acquisition of albumin is described somewhat as follows: "After entering the infundibulum the yolk remains in the so-called albumin portion of the oviduct about three hours, and in this time acquires only 40 to 50 per cent by weight of its total albumin and not all, as has hitherto been supposed.

"During its sojourn in the albumin portion of the oviduct the egg acquires its chalazae and chalaziferous layer, the dense albumin layer, and (if such a layer exists as a distinct entity, about which there is some doubt) the inner fluid layer of albumin.

"Upon entering the isthmus, the egg receives its shell membranes. In passing through this portion of the duct something under an hour's time is occupied.

"At the same time, and during the sojourn in the uterus, it receives its outer layer of fluid or thin albumin, which is by weight 50 to 60 per cent of the total albumin.

"This thin albumin is taken in by osmosis through the shell membranes already formed. When it enters the egg in this way it is much more fluid than the thin albumin of the laid egg. The fluid albumin added in this way dissolves some of the denser albumen already present, and so brings about the dilution of the latter in some degree. At the same time by the process of diffusion the fluid layer is rendered more dense, coming finally to the consistency of the thin layer of the laid egg. The thin albumin layer, however, does not owe its existence in any sense to this dilution factor, but to a definite secretion of a thin albumin by the glands of the isthmus and uterus.

"The addition of the albumin to the egg is completed only after it has been in the uterus from five to six hours.

"Before the acquisition of albumin by the egg is completed, a fairly considerable amount of shell substance has been deposited on the shell membranes.

"For the completion of the shell and the laying of the egg from twelve to sixteen or exceptionally even more hours are required."

This manner of deposition of albumin through the shell membranes by osmosis is difficult to correlate with our present ideas regarding the behavior of colloids and permeable membranes and it may be that the dilution of the albumin is due simply to an addition of water. This matter should be reinvestigated and attempts made to explain the phenomenon in terms

[5] Gerhartz, W.—Uber die zum Aufbau der Eizelle notwendige (Transformation energie)—Pluferg's Arch., Bd. 156, pp. 1-224, 1914.

[6] Pearl, Raymond and Curtis, Marjorie R.—Studies on the Physiology of Reproduction in the Domestic Fowl V. Data regarding the Physiology of the Oviduct.—Jour. Exp. Zool. 12; 1; 99-132; January, 1912.

of our present knowledge of colloidal chemistry.

The physical characteristic of the albumin is that of a translucent liquid without definite structure and, in the fresh egg, free from smell and taste. The albumin is easily coagulated by heat, at about 140 deg. Fahrenheit. It is soluble in water. The albumin can be divided readily into three distinct layers, a thin outer coat, a thicker middle coat and very much denser inner stratum. This dense layer is prolonged in the form of two spirally coiled opalescent cords toward the blunt and narrow ends of the egg respectively; these are chalazae, so-called from the fanciful resemblance to hail stones. In appearance they resemble twisted cords. The two chalazae are twisted in opposite directions. They are attached to the vitelline membrane of the yolk.

The albumin has two distinct functions; the first is that of protection, by forming a thick layer of material around the germ, at the same time it furnishes the material in which it floats, thus protecting it from shocks which otherwise might prove fatal. In other words, it affords the protection to the chick embryo which in mammals is provided by the maternal uterus. The second purpose is that it provides material which goes directly into the formation of tissue for the embryo.

The shell membrane consists of two layers, a thick outer layer next to the shell and a thin inner one next to the albumin. Both of these adhere closely to the shell, the outer one being in direct contact while the inner one is adherent to the outer. At the blunt end of the egg, however, they are separate and form a small cavity or sac known as the air cell. This is filled with air which has been drawn into the egg owing to the evaporation of the liquids. The size of the air cell increasing with the age of the egg. If this cell is found in any place but the large end of the egg, it usually denotes that the egg has been kept for some time and has not been turned; thus the liquids settle and force the air to the highest point. The shell membranes are formed in the isthmus of the oviduct.

The shell is the outer envelope of the egg and its function is primarily that of protection. The shell is composed of three layers: (1) the inner or mamillary layer, (2) the intermediate or spongy layer, and (3) the surface cuticle. The mamillary layer consists of minute calcareous particles about 0.01-0.015 mm. in diameter welded together with air spaces between these particles which communicate with the meshes of the spongy layer, which is several times as thick, and which is bounded externally by the extremely delicate shell cuticle. The spongy layer consists of matted calcareous strands. The shell cuticle is porous but apparently quite structureless otherwise. The cuticular pores communicate with the meshwork of the spongy layer; thus the entire shell is permeable to gases and permits of embryonic respiration, and evaporation of water.

CHRONIC SEPTIC NEPHRITIS IN A COW

A cow brought to the abattoir showed unusual evidence of debility or sickness, arched back, disinclination to move about and general stiffness. Postmortem findings showed excessive appearance of feverishness or dryness of muscles, dark, offensive yellow fat and adipose tissues and discoloration of visceral organs.

The kidneys were decidedly enlarged and on incision through the center were found to be full of slimy thin pus, the ureters were enlarged and there was much evidence of absorption of both urine and pus.

A considerable number of such cases have been found in old cows in the last few years. Those cases where the temperature has been taken have showed some rise in temperature.

W. Ross Cooper.

Kansas City, Mo.

THROMBO-EMBOLIC COLIC

A ten-year-old mule in good condition showed mild colicky symptoms in the evening after a day at corn husking. The owner gave him about one pound of epsom salts in a drench.

The following morning the mule was moaning and very restless. A veterinarian was called who no doubt treated him like one would treat the ordinary case of colic.

Four or five more hours passed and the mule was no better. Although the owner lived a considerable distance from me, I was called, without however, being told another veterinarian had already seen the case. I suppose a question of ethics was involved, but here I was many miles from my office, a considerable fee for mileage already accrued and a very sick mule before me.

I inquired what was done before I came and was satisfied that the local veterinarian had done all that could be done at the time he was called. However, it was up to me to do what more could be done at the time, if anything.

When I arrived, the mule had been sick about twenty-two hours. He was outside, lying and rolling around. His breathing was good, his pulse about 70 and somewhat weak. The temperature was 102° F. Parastaltic movements were at times rumbling, at times silent.

At this time this mule did not show fatal symptoms, nevertheless the fact that he had been sick 22 hours and had plenty of purgatives in him with apparently no effect, caused me to give a guarded prognosis.

I made a careful rectal examination. I could feel nothing abnormal. The contents of the large bowel seemed soft. There was no bloat and to all appearances one would expect passages any moment. I gave one-quarter grain doses of arecoline at 30 minute intervals until three doses were given. I left nux vomica, aromatic spirits of ammonia and guiaicol solution to be given every four hours during the night.

In the morning the owner telephoned that the mule was more quiet but really seemed to look worse otherwise. I told him I thought the animal probably would die but that I should like to see him. When I arrived I saw death written all over the mule. His pulse was very rapid, almost imperceptible; temperature 104° F.; respiration bad. He was led out of the barn and in ten minutes dropped dead.

The owner agreed to a postmortem examination. By this means I was able to make a positive diagnosis of thrombo-embolic colic. Just about two feet of the ileum before it joins the cecum was black as tar and gangrenous. The mesenteric vessels for upward of about a foot or more were black and full of blood clotted hours before. I suspected an embolus and so investigated at the top of the clot in the vessels. I cut into the vessel and found a mass which seemed about as big as a match head somewhat hard and brownish in color. The cause of this I attribute to strongyli, for in the cecum and colon there were enormous numbers of strongyli causing innumerable ulcer like sores at places of attachment.

The value of postmortem examination lies in the fact that it leads to an accurate diagnosis in obscure and incurable cases. It establishes a better confidence in drugs which we might condemn when they seem to fail us because we see that such cases are beyond the possibility of satisfactory treatment.

You will find, fellow practitioners, that if you make it a rule to autopsy as many of the cases you lose as possible, that in the large majority of such cases, you can show to the great satisfaction of a client that no power on earth could have cured the animal.

Postmortem examinations lead also to other benefits. As in this instance, the client saw that worms were figuratively eating up his animals. In no other way could this have been so forcibly impressed upon his mind. I too learned from the postmortem examination. I also benefited financially because I treated the rest of the horses and mules on the farm for parasites.

In Illinois, tuberculosis kills 400 negroes per year out of each 100,000; of whites, it kills but 60 out of each 100,000.

WHAT'S THE MATTER WITH US?

In that part of Illinois where I practice, I am constantly discovering some combination of "the Devil only knows what" that is sold, peddled or distributed amongst my clients and claimed to correct, cure or control some of the ailments usually supposed to be a part of a veterinarian's prerogatives. For instance, some one claims to have a cure for garget, and travels through the country, selling a treatment that the owners of dairy herds claim to get satisfactory results from.

Then, the local grocery sells and advertises "kowkare" that will do almost anything from correcting sterility to expelling the retained placenta of a cow and I find it in nearly every cow barn that I enter. It is actually sold by the ton to distributors.

Then we have representatives of the Dr. David Roberts Veterinary Company traveling over the entire dairy district treating cows for abortion and sterility—figuratively speaking, for anything from anthrax to zestocausis. Then there are several agents that offer their services to the farm women, who are trying to raise poultry. These agents claim to attend a poultry school of instruction from four to six weeks and in that time learn more about poultry problems than any veterinarian can learn in four years of study and twice as many more years of experience in practice. Some of the less modest claim to know ALL about the diseases of poultry.

I could go on with a dozen more similar complaints, but what's the use? What is the matter with the veterinary profession? Are veterinarians so dull that they cannot learn all that is to be learned about poultry problems in a lifetime, while a blockhead of an agent can learn it all in six weeks? What is the trouble with the current veterinary literature that it doesn't give out the information needed to make its readers more efficient and as capable of giving advice to the poultryman or poultry woman than are the "mushroom" agents?

What does kowkare contain that it fools so many brilliant dairymen? I have a good practice, but many times I am called when all the other resources first have been given a chance and bossy is just ready to go to her eternal home and they want a prayer said before she goes. In addition, there are mineral feed agents scouring the country to sell some Glauber's salt in disguise. Many of them have a line so smooth that they almost believe it themselves, and they can sell and collect from the poor honest farmers to whom I have been extending credit for years. These same agents worm pigs free if the farmer will buy the worm remedy from them at from $18 to $27 per gallon when the same product can be bought from his retail drug store for $8.50 per gallon.

When I see all of this taking place around me, I wonder what is the cause? Does the farmer want to be humbugged? Are these high pressure salesmen irresistible? Or are the veterinarians of so little value that these resources must be resorted to?

Just a few days have passed since I was told by one of my clients that a brother of his owned a cow that was in much worse condition than the one I was treating for mammitis, and an agent selling a garget remedy came along the road selling a powder to give the cow and the cow was cured and was perfectly all right at the time.

When I treat a cow for mammitis, I usually use a mixed bacterin daily together with massage of infected part and advise frequent milkings. I have given ounce doses of formalin and potassium nitrate, together with laxatives and then failed to restore the patient to normal condition. What does the other fellow use that he can get such testimonials from the dairyman? I would like to hear what other veterinarians use and with what success. I have had wonderful results following treatment of an en-

tire herd with mastitis mixed bacterin 20 cc. per dose one week apart for three weeks, as a preventive of mastitis. In fact, all trouble seems to stop in the herds so treated, but the cases already infected do not recover completely for me, at least by no means all of them make a complete recovery. I have never found a treatment that will expel a placenta satisfactorily except manually removing it, then introducing two ounces of flavisol.—C. B. H., Illinois.

Comment: The foregoing is presented for general discussion.

The problem that exists in the Illinois locality referred to has probably existed in every locality. It has been solved by many individuals in all sorts of localities, but in more instances, it has not been solved.

In a recent issue of the Practitioner's Bulletin, J. F. DeVine calls to mind an even worse situation of the same kind that he had to contend with when he established himself in practice more than twenty-five years ago.

His prescription for solving it is to give such good service that the peddler doesn't fit in. And, he goes ahead to point out that good service doesn't consist alone in treating cases according to the best known methods. It consists in even such simple things as answering the telephone properly. In making calls when the client wants them made. Of keeping promises; in not telling a man you will be out in an hour and arriving several hours later; in not telling the man you will see his herd early next week and then forgetting all about it.

It consists not only in proper diagnosis and correct treatment, but in supplying a treatment not only a great deal better than the peddler's remedy, but one as easy to administer and as pleasing in appearance; not in "advising frequent milkings" as the correspondent says he does, but in prescribing or directing that the affected udder be stripped clean every hour, or every two hours and doing it in such a way that the directions will be followed implicitly.

Doctor DeVine further holds that it is ridiculous for a veterinarian to think of carrying on a big practice by simply writing prescriptions. Not only does it delay relief and add greatly to the troubles of the live stock owner, but encourages the client to go to the drug store instead of to the veterinarnian's office. He goes on to say:

"Not to leave medicine with a client because he may later want to buy more of the same medicine and treat his own animals is illogical. The average client takes care of his own animals except the very sick ones. He likes to treat them. He has always done it and wants to continue doing it. Here is where the quack remedies get credit. They are used in simple cases that would have recovered anyhow.

"If the live stock owner had on hand some of his own veterinarian's medicine, he would use that instead of buying from the peddler, and if the case recovered, the veterinarian's medicine would get the credit and he and all his neighbors would be coming to the veterinarian's office instead of going to the drug store, or the feed store, or patronizing the itinerant peddler of home remedies.

"Except for ability and honesty to warrant the confidence of the community, there is nothing else that will help to build up a practice and hold it better than dispensing useful formulae properly labeled.

"Fourth on the list of Practice Builders comes an office and an institution in keeping with the community or the character of the practice."

It costs more to employ a veterinarian than it does to use a peddler's remedy. The livestock owner must get better results from the greater expense, and of course, he does, but that alone is not sufficient. He must know that he gets them. Of course, an occasional afterbirth will come away after a dose of gunpowder or any other ingredient has been given. If the peddler's remedy gets credit for all the ministrations of *vis medicatrix naturae* his remedies should

get the blame for some of its failures, and it is part of the veterinarian's business to see that it does.

When the veterinarian is called "to say the prayers," he should make it a point to see that the owner of the animal remembers the circumstances, and of course, that means that his memory should be stimulated through his pocket book.

Every veterinarian realizes that on the whole, his practice must be profitable to his clients if he is to continue, and of necessity must take this circumstance into consideration in making his charges for cases where his efforts are unavailing. But, it is a different matter where he is not called until the case is hopeless. In such cases, it is doing his client a service to teach him effectively and forcefully the exact reason for his loss, and to do it in a way that he will remember it. Every veterinarian realizes that veterinary medicine is a science and an art. Let him not forget that veterinary practice is a profession and a business. It is not desirable that he meet the peddler on the peddler's plane of business, but, on the other hand, the peddler cannot meet him on the veterinarian's professional plane.

Of course, the farmer likes to be humbugged if it is well done. So does everyone else. But, there is a limit to the humbuggery that can be practiced on even the most gullible, and that limit in the matter of treatment and prevention of animal diseases, is set in each community pretty much at the point that the veterinarian practicing in there, permits it to be set. It is just too bad if a veterinarian who lives in a community has not the confidence of that community to a greater extent than has an itinerant peddler.

A Saanen Buck

NEURITIS IN A BOSTON TERRIER

I am writing for information regarding a condition which I was called to treat in a 7-year-old Boston bull terrier belonging to an M.D. The animal always rode in his car, sitting in the back window of a coupe, and recently has developed a condition which alarms the owner.

The trouble appeared to begin when this Boston had a misunderstanding with a skunk and vomited a great deal of very black material. She refused her feed and developed bowel trouble, which we got back to normal condition. She eats raw meat, milk, beef broth, raw eggs and all the water she wants, and table scraps. She was spayed four years ago and is in very good condition.

At times the animal appears as normal as any dog, and all at once will be all humped up and start to cry. She will hold the muscles very rigid for possibly one hour, and her neck seems to be stiff and the muscles seem to be very pronounced. She will carry her head in a twisted manner to the right side, and her back arched. Temperature, 101° F. Pulse, 100. Sometimes in moving her head she seems in great pain. Any information that any reader will give on this case will be greatly appreciated.—J. R. W., Michigan.